# NAVAL POSTGRADUATE SCHOOL
## Monterey, California

# THESIS

AN INVESTIGATION OF THE FEASIBILITY OF
MANNING THE AIRWINGS OF THE PROJECTED
FY 1990 CARRIER FORCE

by

John J. Infield

December 1981

Thesis Advisor:                    Richard S. Elster

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An Investigation of the Feasibility of Manning the
Airwings of the Projected FY 1990 Carrier Force


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This thesis is a study of the feasibility of manning the airwings of a fifteen carrier force by FY 1990. An initial review of the history of the carrier force and the composition of its airwings and the manpower requirements needed to man them was accomplished. Manpower studies were conducted of the 131X/132X designators for officers and for eleven selected enlisted aviation ratings (AD, AE, AME, AMH, AMS, AO, AW, AT, AW, AX and PR). Specific predictive information used included personnel attrition, retention, promotion and accession data. All of this information was processed by an APL computer program designated MANMOD, which allowed projection of manpower requirements and personnel supply data forward to the year 1990. The MANMOD model permitted estimation of the accessions and retention requirements for the officer designators and enlisted ratings chosen for study. This projection of data provided predictions on whether current-day policies will meet future billet requirements or whether changes in policies will have to be made in order to man a fifteen-carrier force. This thesis indicates serious problems in manning if present supply and requirements trends continue. The thesis also identifies other manpower problem areas.

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# I. INTRODUCTION

The manning of the all-volunteer force has been a problem since its inception. Without the draft to produce a steady flow of personnel into the armed forces, it has become necessary for those in command to examine, in depth, the administrative policies which affect the maintenance of a strong, peace-time volunteer force. In the face of the present administration's avowed commitment to expand the size of the Navy to a six hundred ship force, which will embody a fifteen aircraft carrier complement, the feasibility of providing trained personnel for such a force by FY 1990 becomes a critical question.

This thesis addresses itself to the study of the airwings of the FY 1990 fifteen carrier force. Its purpose is to discover whether the projected billet requirements can be met, and to identify serious problem areas. Such a study is of potential value to the Navy in that it identifies those rates and designators which may have personnel shortfalls over the next decade.

To accomplish this study, a review was initially made of past and present data relating to three major factors which control the effective manning of all the armed services: attrition, retention and accession.

The cost, both in financial terms and in operational
readiness, of the attrition rate cannot be minimized, nor
can the impact of low retention rates through both the
pyramidical officer rank structure and the enlisted struc-
ture. The shortage of mid-management personnel, especially
in the aviation community, is a matter of great concern.
The civilian aviation job market virtually relies on the
military to train its technicians and pilots. Low enlisted
pay scales, particularly in the first few years of service,
and the noncommensurate salaries paid to aviators, coupled
with various other factors such as family separations, have
combined to make the offer of civilian employment attractive.
Civilian aviation expansion projections for the next decade
offer no decline in demand for trained and experienced
personnel.

Beyond the question of attrition and retention is the
problem of accessing sufficient personnel to compensate for
losses and to provide needed growth. As this thesis will
state, the pool of potential officers and enlistees is shrink-
ing rapidly over the upcoming ten years at the very time when
demand for personnel is seen as sharply increasing.

An APL program designated MANMOD was utilized in this
thesis to project personnel accession, retention and attri-
tion data to the year 1990 in order to provide predictions
of areas of personnel shortages or overages in the fifteen-
carrier airwing manning complement. This model allows for

the determination of the impacts of changes in accession, retention, promotion and attrition on future manpower availability.

The next chapter of this thesis investigates the size and role of today's carrier force and its present airwing manning status. It will also discuss the proposed future carrier strength requirements. Chapter III will present a study of past and present aviation officer and enlisted retention and attrition data. Chapter IV will utilize the APL program MANMOD to predict aviation officer and enlisted supply vs. demand in FY 1990, using billet numbers, and accession, attrition, retention and promotion rates as variables. Finally, in Chapter V, conclusions are drawn concerning the feasibility of manning the FY 1990 fifteen carrier force.

## II.  NATURE OF PROBLEM

Every branch of the Armed Forces must, by definition, operate to fill the defense needs of this country as set out by the Department of Defense and, further, do so within the confines of the budgetary restrictions placed upon it by the Congress.  The Navy, no less than any of its fellow services, has over the years undergone changes mandated by the various administrations in response to their views of the perceived threat to this country.

It is not surprising, then, to find that in the course of these years the demands and expectations placed upon the Navy have varied with the state of foreign relations, national opinion, technological progress and economic constraints.

The United States Navy in FY 81 finds itself with a multitude of present and future manpower problems.  Retention of trained personnel and recruitment of suitable potential rated personnel and officers has become of crucial concern to the service, particularly in light of the latest fleet force projections outlined by the Secretary of the Navy (SECNAV).  John Lehman, Jr., the present Secretary of the Navy, stated [Ref. 1]:

> We are at a major turning point in the history of our nation, with a new turn in policy which includes a stronger Navy.  The President is totally committed to a stronger naval force to cover a three ocean requirement and protect the sea lanes.

We will have a 600-ship Navy built around fifteen battle groups.

## A. CARRIER FORCE

Two decades ago the carrier force numbered 24; of that number 15 were considered attack carriers (CV's or CVN's for nuclear powered types) and 9 were anti-submarine warfare (ASW) carriers.

Table I shows there has been a slow and steady decline in the number of carriers from 1964 until the present force of only 13 CV/CVN's [Ref. 2]. This in itself might be considered unusual because the time frame encompassed the Viet Nam conflict. The naval force remained fairly steady until the withdrawal of American support from Viet Nam, and then there was a steady decline in the number of Navy ships [Ref. 3]. This steady decline in ships of all types, not only in aircraft carriers, is more dramatically shown in Figure 1 where the total active fleet force of ships can be seen to bottom out at around 415 in number [Ref. 4]. In a decade and a half, the number of ships was reduced by slightly over 54 percent. The number of ships planned was on the increase during the Ford administration, but shipbuilding cuts by the Carter administration reduced the number of ships projected for the 1990's [Ref. 5]. Included in this shipbuilding budget cut was a CVN. Since this thesis deals with the manning of carrier airwings in particular, it is worthy of mention that inherent in the reduction of the carrier force is the simultaneous

TABLE I

CARRIER FORCE HISTORY

Fiscal Year

| | 64 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Attack carriers (CV/CVN) | 15 | 15 | 15 | 15 | 14 | 14 | 14 | 14 | 15 | 13 | 13 | 13 | 13 | 13 |
| ASW carriers (CVS) | 9 | 8 | 7 | 4 | 4 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 24 | 23 | 22 | 19 | 18 | 17 | 16 | 14 | 15 | 13 | 13 | 13 | 13 | 13 |

Source: Historical Budget Data, April 1979, Department of the Navy, Office of the Comptroller.

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FORD/CARTER PROJECTIONS OF NUMBERS
OF GENERAL PURPOSE SHIPS
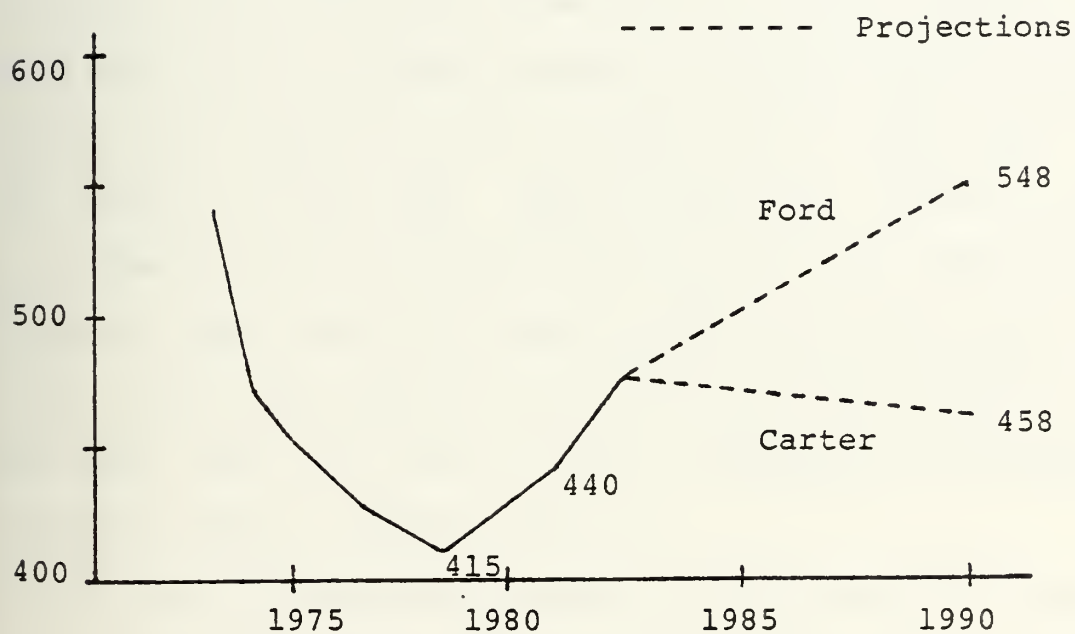


Source:   Estimates of Military Officer Force Structure
          Required to Man the Projected Naval Combatant
          Forces of 1980's and 1990's.   Naval Postgraduate
          School Technical Report, NPS 55-80-015, October
          1980.


Figure 1

reduction in requirements for airwing personnel, both officer and enlisted.

B. CARRIER ROLE

Another factor leading to the present situation was a change in the naval carrier role. The last of the World War II (WW II) carriers used for ASW left active service in FY 73. Until this time there had been two types of aircraft carriers, or rather, two different roles for an aircraft carrier. The main role was to project airpower, accomplished with the fighter and attack aircraft of the attack carrier [Ref. 6]. The second role was ASW. The ASW carrier's job was to aid in protection of the attack carriers from the submarine threat. This job, ASW, was also given to other ships, but the CVS's could extend this protection further from the CV/CVN's. The ASW ships were also part of the air defense net covering the CV/CVN's from air attacks [Ref. 7].

In order to keep the extended coverage that ASW aircraft could give the carrier, the two roles were combined into a single carrier operation. Carriers were required to carry fighter, attack and ASW aircraft. This, of course, reduced the number of fighters and attack aircraft, and therefore decreased the amount of projected power a CV/CVN could produce [Ref. 8]. To correct this deficit, the Navy asked for and received, after constant Congressional battles, larger and larger carriers until reaching the Nimitz class carriers of today [Ref. 9].

## C. PRESENT CARRIER FORCE

Figure 2 shows the present carrier force level and the projected force strength through year 2010 [Ref. 10]. The aircraft carrier Lexington (ATV-16) operates as a training carrier and is not counted as one of the 13 CV/CVN's.

In 1983, the Coral Sea (CV-43) was to have taken over the training carrier Lexington's role and become ATV-43. The USS Vinson (CVN-70), when commissioned in FY 82, would then have maintained the carrier force strength at thirteen. The last of the WW II type carriers, the Midway (CV-41), would have been decommissioned in FY 85, with the new CVN-71, as yet unnamed, becoming operational to replace her. This would have kept the force level at thirteen until the end of the 1990's, at which time the retirement of the Forrestal (CV-59) would have decreased the number to twelve. The new thirteenth carrier to replace the Forrestal fell afoul of the Carter administration's budget cuts [Ref. 11].

## D. PRESENT AIRWING MANNING

In holding the carrier force steady in number, the number of airwings would have also remained at its current level (eleven airwings). (It should be explained that there are only eleven airwings for thirteen carriers, because there are usually two carriers in the Service Life Extension Program (SLEP)). SLEP requires placing a carrier into a shipyard for a period of approximately two years. At the present time, the SLEP program is taking longer than two years to complete

PRESENT/PROJECTED CARRIER FORCE

| NOTE # | CARRIER'S NAME | HULL # | YEARS |
|--------|----------------|--------|-------|
| | | | 1980 1985 1990 1995 2000 2005 2010 |
| 1 | LEXINGTON | (16) | ----- |
| | CORAL SEA | (43) | ------3----------------------------------- |
| | MIDWAY | (41) | ----- |
| | FORRESTAL | (59) | ------3------------------------ |
| | SARATOGA | (60) | ---3----------------------- |
| | RANGER | (61) | -------------3---------------- |
| | INDEPENDENCE | (62) | ----------3--------------- |
| 2 | KITTY HAWK | (63) | -------------3--------------- |
| 2 | CONSTELLATION | (64) | ---------------3----------------- |
| 2 | ENTERPRISE | (65) | ---------------3----------------------- |
| 2 | AMERICA | (66) | -------------------3----------------------- |
| 2 | KENNEDY | (67) | -------------------3----------------- |
| 2 | NIMITZ | (68) | ----------------------------------------3----- |
| 2 | EISENHOWER | (69) | ----------------------------------------3---- |
| | VINSON | (70) | ------------------------------------------- |
| | XXXXXX | (71) | ------------------------------------- |

1980   1985   1990   1995   2000   2005   2010
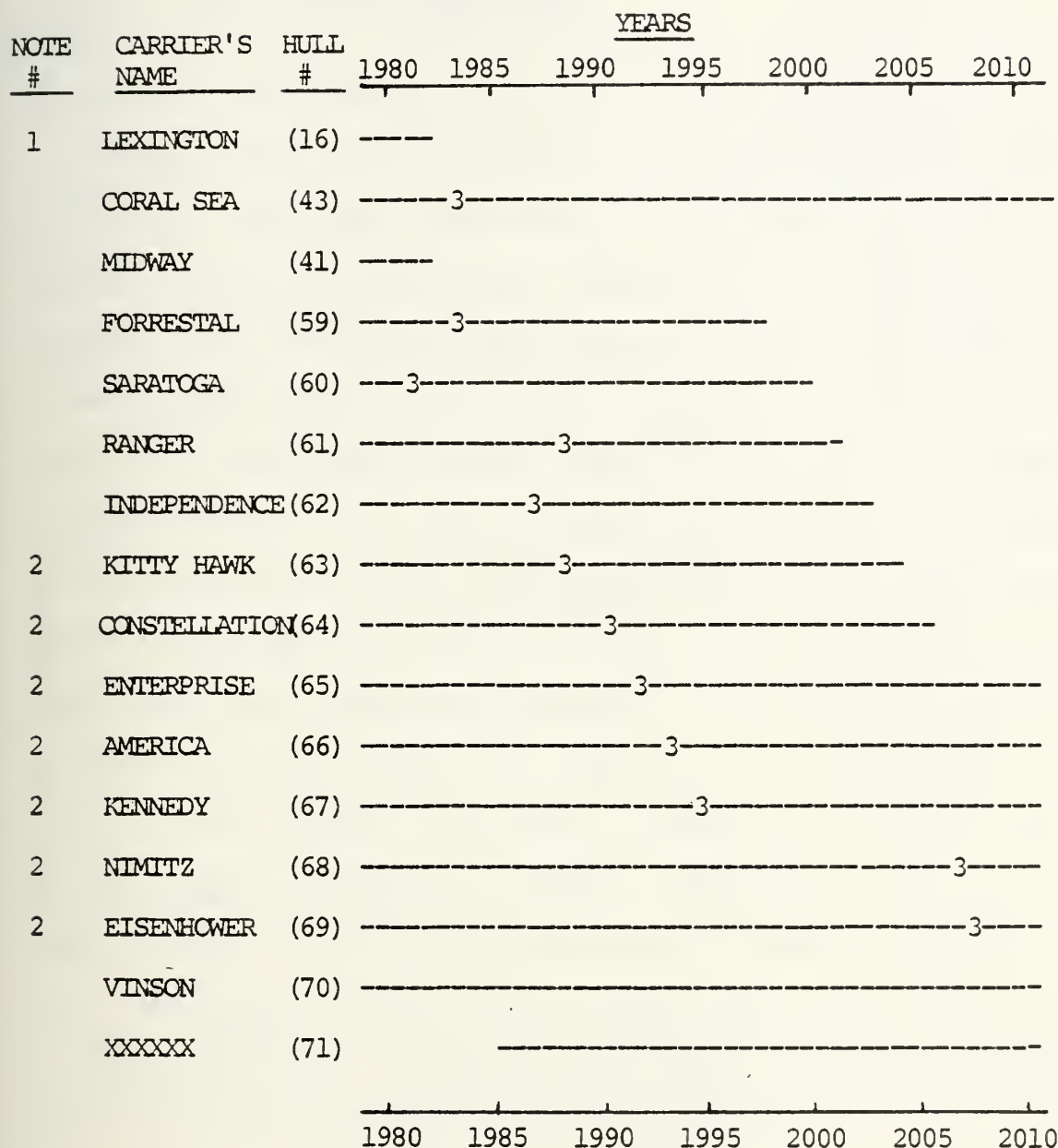
YEARS

Notes:
1. AVT-16 operates as a training ship and is based at Pensacola, Florida. It is anticipated that CORAL SEA (43) will replace LEXINGTON in the training role about 1983.
2. Tentative Service Life Extension Program under consideration for these ships.
3. Tentative two year Service Life Extension Program Schedule.

Source: Janes Fighting Ships 1980-1981 Edition, Franklin Watts Inc., New York

Figure 2

its rehabilitation of aircraft carriers. At the time of this writing, the USS Enterprise (CVN-65) has been in the shipyard for almost three years.

E.  PERCEIVED THREAT

While the United States has been decreasing the number of ships in its Navy, the Soviets have been increasing theirs, until they now have a superiority in number of fleet ships. This superiority has changed the U.S. Government's view on the size of our own Navy [Ref. 12]. Figure 3 shows how perceived threat affects force structure and manning structures [Ref. 13]. The Reagan administration is committed to increasing our Navy from approximately 440 combat capable ships presently to a force of 600 by the end of FY 90 [Ref. 14]. Why this sudden turn around? It is in response to the belief that the Soviets have equalled, if not surpassed, the U.S. in naval power. Following is part of a speech delivered by Vice Admiral Ernest R. Seymore, Commander Naval Air Systems Command, as part of a briefing for industry [Ref. 15].

> For years we have acknowledged that the Soviet Union held a quantitative lead in military equipment, but believed that our qualitative lead would more than compensate for this. It is time to reexamine that belief and to reject the complacency that went with it.
>
> During the decade of the 1970's the Soviets made a major advance in the development and production of defense material and, as a consequence, will enter the 1980's in a dramatically different defense posture than they had as they entered the 1970's. Their objective was to challenge the United States lead in defense technology while maintaining their numerical advantage. They have had a remarkable degree of success in achieving that objective

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DERIVATION OF THE FUTURE NAVY FORCE STRUCTURE AND OFFICER REQUIREMENTS
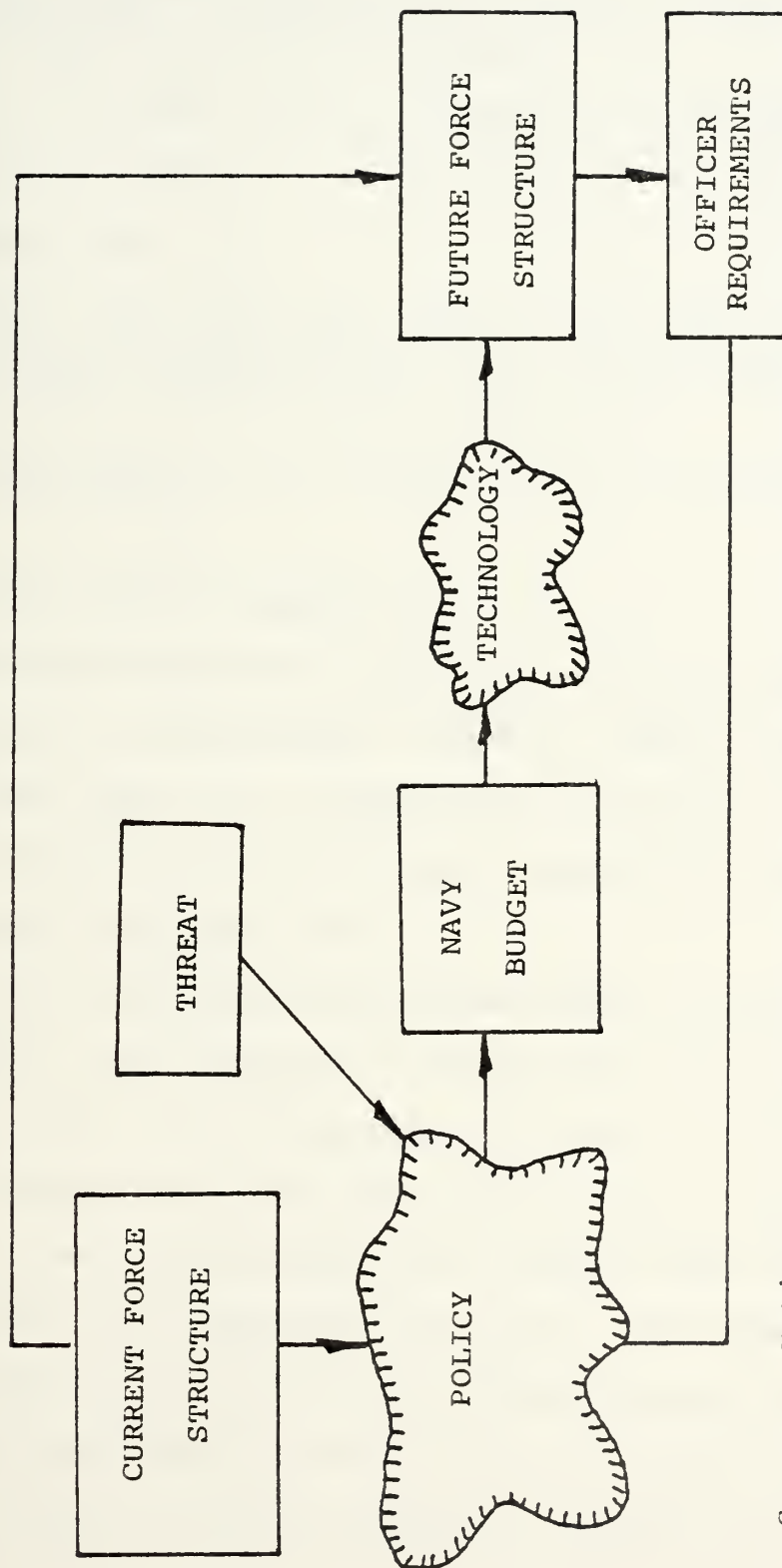


Source:  Estimates of Military Officer Force Structure Required to Man the Projected Naval Combatant Forces of 1980's and 1990's, Naval Post-graduate School Technical Report, NPS 55-80-015, October 1980.

Figure 3

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by making an enormous investment, and by maintaining an unwavering emphasis on technology.

In sum, we see the Soviets entering the decade of the 1980's with a commitment to compete in equality with United States weapon systems.

This line of thought was also supported by the Secretary of the Navy when asked for a frank appraisal of U.S. military preparedness [Ref. 16].

Overall our capability today is in a very dangerous position.....we have lost both our naval and strategic nuclear edge of superiority. As an island nation we must maintain military naval superiority.

I can assure you all today.....we are finished with being second best.

F. PROPOSED CARRIER STRENGTH

To increase the Navy's size with new ships would take a major effort in shipbuilding. Figure 4 shows a new projected carrier force that will increase from thirteen to fifteen attack carriers--which will be the nucleus of a fifteen battle group force [Ref. 17].

In order to achieve this increase from thirteen to fifteen CV/CVN's, the Lexington (ATV-16) will remain the training carrier [Ref. 18]. The Coral Sea (CV-43) will enter SLEP and continue on active duty as an attack carrier. This will bring the carrier force up to fourteen when the Vinson (CVN-70) makes its appearance in FY 82. The fifteenth carrier would in all probability be the unnamed CVN-71.

To maintain the force at fifteen past FY 85, the Midway (CV-41) would not be decommissioned. Whether it would enter

PROPOSED/PROJECTED CARRIER FORCE

| NOTE | CARRIERS NAMES | HULL # | YEARS |
|------|----------------|--------|-------|
| | | | 1980   1985   1990   1995   2000   2005   2010 |
| 1 | LEXINGTON | (16) | ------------------------------------------------- |
| 2 | ORISKANY | (34) | ------------------------------------------- |
| | CORAL SEA | (43) | --------------------------------------------- |
| | MIDWAY | (41) | -------------------------- |
| | FORRESTAL | (59) | -----4--------------------------- |
| | SARATOGA | (60) | ----4------------------------ |
| | RANGER | (61) | ----------------4------------------ |
| | INDEPENDENCE | (62) | ------------4------------------ |
| 3 | KITTY HAWK | (63) | ------------------4----------------- |
| 3 | CONSTELLATION | (64) | --------------------4--------------------------------- |
| 3 | ENTERPRISE | (65) | --------------------4--------------------------------- |
| 3 | AMERICA | (66) | ----------------------4----------------------------- |
| 3 | KENNEDY | (67) | -----------------------4----------------------------- |
| 3 | NIMITZ | (68) | ----------------------------------4----------- |
| 3 | EISENHOWER | (69) | -----------------------------------4---- |
| | VINSON | (70) | ------------------------------------------------- |
| | XXXXX | (71) | ----------------------------------------- |

```
        1980   1985   1990   1995   2000   2005   2010
                            YEARS
```
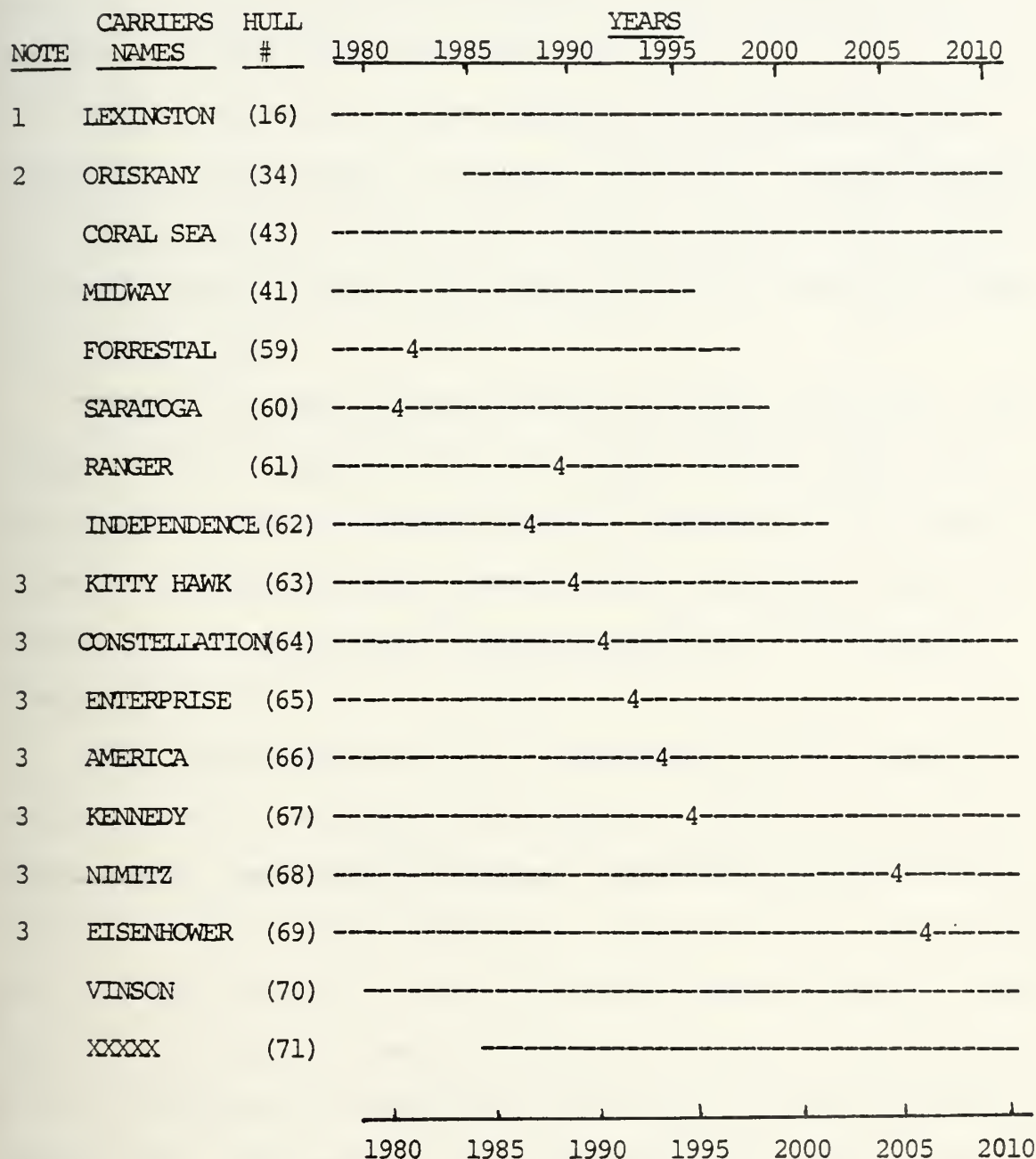
Notes:
1. AVT-16 continues to operate as a training ship.
2. CV-34 ORISKANY brought back into service
3. Tentative schedule (SLEP) under consideration for these ships.
4. Tentative two year SLEP schedule.

Source: Janes Fighting Ships 1980-1981 Edition, Franklin Watts Inc.,
New York City, and the Department of the Navy, OP-01.

Figure 4

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SLEP at that time is not known.  The Navy has also expressed

the desire to bring the Oriskany (CV-43) out of mothballs

and use it as an amphibious support ship manned by two

Marine A-4 Skyhawk attack aircraft wings.

Table II shows the time schedule and manning levels

suggested by the Navy to Congress [Ref. 19].  This proposal

was not accepted for the FY 81 budget, but the Navy hopes

to again place it into the budget for FY 82, and this time

get it approved.

Table III shows the projected timetable for Naval car-

riers and for increases in other force levels [Ref. 20].

This table does not include the ATV carrier in its count.

A major problem the Navy faces in the increase in carrier

forces is providing the necessary manpower at the times

needed [Ref. 21].

With the Coral Sea (CV-43) remaining on line and the

Vinson (CVN-70) entering into service, the Navy already has

one airwing less than it needs.  (By having two carriers in

SLEP and eleven active carriers, there is only a requirement

for eleven airwings.  But, with having twelve active, there

would be a need for twelve airwings in order to have each

carrier perform its combined ship/airwing training prior to

deployment.  One airwing could support two carriers, but this

would leave the airwing/squadrons without enough time for

their required one year of shore-based training.)  A naval

airwing for the Oriskany (CV-34) is not required, because,

## TABLE II

### MANPOWER REQUIREMENTS FOR THE ORISKANY

| FY 82 | FY 83 |
|---|---|
| 74 Officers/1285 Enlisted | 116 Officers/2085 Enlisted |

ORISKANY manpower requirements with an added 30 percent standard factor for shore and sea billets other than those billets required for squadron manning.

| FY 82 | FY 83 |
|---|---|
| 96 Officers/1671 Enlisted | 151 Officers/2711 Enlisted |

Airwing requirements vary with number and mix of aircraft in wing.

Range of airwing options beginning in FY 83.

#### FY 83

| | |
|---|---|
| Minimum (40 aircraft) | 92 Officers/922 Enlisted |
| Maximum (60 aircraft) | 189 Officers/1342 Enlisted |

Range of airwing options with an added 30 percent standard factor for shore and sea billets other than those billets required for squadron manning.

| | |
|---|---|
| Minimum (40 aircraft) | 120 Officers/1606 Enlisted |
| Maximum (56 aircraft) | 247 Officers/1606 Enlisted |

Total ORISKANY airwing manpower requirements with an added 30 percent factor for shore and sea billets other than those billets required for squadron manning.

| | FY 82 | FY 83 |
|---|---|---|
| Minimum (40 aircraft) | 96 Off/1671 Enl | 271 Off/3946 Enl |
| Maximum (56 aircraft) | 96 Off/1671 Enl | 398 Off/4317 Enl |

TABLE III

PROPOSED DEPLOYABLE SHIP TIME TABLE

| | FY81 | FY82 | FY83 | FY84 | FY85 | FY86 | FY87 | FY88 | FY89 | FY90 |
|---|---|---|---|---|---|---|---|---|---|---|
| CV/CVN$_1$ | 13 | 14 | 14 | 14 | 15$_2$ | 16 | 16 | 16 | 16 | 16 |
| BB | 0 | 0 | 1 | 2 | 2 | 2 | 3 | 4 | 4 | 4 |
| CG/CGN | 27 | 28 | 29 | 30 | 32 | 35 | 38 | 41 | 43 | 45 |
| DD/DDG | 82 | 83 | 84 | 84 | 84 | 82 | 82 | 84 | 86 | 86 |
| FF/FFG | 79 | 79 | 85 | 91 | 96 | 98 | 103 | 108 | 113 | 113 |
| SS/SSN | 92 | 98 | 103 | 107 | 109 | 109 | 109 | 109 | 112 | 112 |
| SSBN$_3$ | 36 | 34 | 33 | 34 | 35 | 35 | 36 | 37 | 38 | 39 |
| AMPHIB | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 | 63 |
| UNREP | 33 | 33 | 33 | 32 | 32 | 31 | 31 | 31 | 31 | 31 |
| MAT SUPT | 27 | 29 | 30 | 31 | 31 | 31 | 31 | 31 | 31 | 31 |
| FLT SUPT | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| OTHER | 8 | 11 | 11 | 11 | 13 | 15 | 21 | 29 | 37 | 37 |
| TOTAL | 477 | 489 | 503 | 516 | 529 | 550 | 567 | 587 | 608 | 611 |

Notes:  1. Includes CV in SLEP and does not include the training carrier LEXINGTON AVT-16.
2. Adds ORISKANY (CV-34)
3. Includes SSBN conversion.

Source: These data were gathered from various sources and were presented in a manpower class at the Naval Postgraduate School, MN 4106 MPT Policy Analysis, in June 1981. The course addressed the question of how to man a 600 ship Navy.

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as stated previously, Marine aviators are scheduled to man the Oriskany's squadrons.

One reason the Navy has had to maintain only eleven airwings for thirteen carriers is the existence of the SLEP program. If, however, the SLEP program is shortened so more carriers can be deployed, a greater airwing shortage will immediately be felt by the Navy. (If the SLEP program is reduced to one year intervals in order for the United States to cover all its carrier commitments, then there would have to be one airwing for each carrier.) (An airwing can have two deployments of six month duration and one year ashore for training during a two-year SLEP program. In this way airwings can move between ships and cover all commitments. But if the SLEP program is lessened to one year, the airwing/squadrons would have to deploy with a particular carrier and train ashore while that carrier was in SLEP. The airwing would then be available to that carrier for their combined ship/airwing training cycle. This would not allow the airwing to be utilized on another carrier.) The suggestion that SLEP may be changed and a greater number of airwings required is based on the number of carriers needed to fulfill commitments as listed by ocean: one in the North Atlantic for the North Atlantic Treaty Organization (NATO) commitment, two in the Mediterranean, one or two in the Indian Ocean, and at least one, and perhaps two, in the Pacific Ocean. This would entail a force anywhere from five to seven carriers at sea

at any given time. If the normal six-month deployment per carrier is maintained with one carrier working up its airwing and the ship's new crew, one in the yards for overhaul, with its airwing working its new personnel into the squadron, then fifteen to twenty-one carriers would be needed to maintain the global commitments of the United States. (Prior to the Soviet's placing ships in the Indian Ocean, the standard carrier deployment length was six months. This length of time was selected because it helped retention. Longer deployments are said to cause higher attrition rates because of family separation. At this time, the standard deployment length is eight months, so that the United States can keep a carrier in the Indian Ocean.)

To help meet the carrier commitment, the Navy has asked for two more Nimitz class carriers to be approved and built before the end of this decade. Congress may not want to approve these large Nimitz class carriers, as in the past they have favored smaller, less costly carriers. [Ref. 22].

The larger carriers have two roles, as previously stated, attack and ASW, while at this time the smaller carriers could only do one role effectively. Also, if Congress chose smaller carriers, the surface Navy would require more manpower to run these additional ships than to man a large, single Nimitz class carrier. The average size crew for a Nimitz class carrier is 3300 men, officers and enlisted, whereas the smaller Forrestal class requires 2800 men.

It seems, therefore, that it might take 5600 men to man the two smaller ships which would be required to replace the Nimitz class carrier.

G.  MANNING

The approximate airwing manning levels needed to man the present carrier force are shown in Table IV.  It can be seen that as the carrier class changes, so does the requirement for airwing manpower change.  From the Midway class to the larger Nimitz class carrier there is a required 32 percent increase in number of officers and a 72 percent increase in the enlisted force to support the new airwing.  The numbers given are for maximum manpower requirements, and may change depending on whether the carrier force wants fewer or more attack aircraft.  In other words, a carrier may increase or decrease its deck load (number of aircraft a carrier can accommodate) depending on its mission [Ref. 23].

To investigate thoroughly the manpower requirements of the airwings, it is necessary to divide the personnel into officer and enlisted, and to separate these by designator and grade, and by rating and paygrade.  The Squadron Manning Documents (SQMD's) will be used for this purpose.  First, it is necessary to make a determination as to what type of squadron will be used in a model airwing's composition. Normally an airwing for a larger carrier (Nimitz class) operates 85 to 95 aircraft consisting of the following:

TABLE IV

TYPICAL CARRIER AIRWING MANPOWER FORCE BREAKDOWN

| CARRIER | # | TOTAL SIZE | OFFICERS | ENLISTED |
|---------|-----|------------|----------|----------|
| LEXINGTON | (16) | 0 | 0 | 0 |
| ORISKANY | (34) | 0 | 0 | 0 |
| MIDWAY | (41) | 1800 | 270 | 1530 |
| CORAL SEA | (42) | 1800 | 270 | 1530 |
| FORRESTAL | (59) | 2150 | 356 | 1794 |
| SARATOGA | (60) | 2150 | 356 | 1794 |
| RANGER | (61) | 2150 | 356 | 1794 |
| INDEPENDENCE | (62) | 2150 | 356 | 1794 |
| KITTY HAWK | (63) | 2150 | 356 | 1794 |
| CONSTELLATION | (64) | 2150 | 356 | 1794 |
| ENTERPRISE | (65) | 2400 | 356 | 2044 |
| AMERICA | (66) | 2400 | 356 | 2044 |
| KENNEDY | (67) | 2400 | 356 | 2044 |
| NIMITZ | (68) | 3000 | 356 | 2644 |
| EISENHOWER | (69) | 3000 | 356 | 2644 |
| VINSON | (70) | 3000 | 356 | 2644 |
| XXXXXX | (71) | 3000 | 356 | 2644 |

Note.  There is a 32 percent increase in officer billets and
       a 72 percent increase in enlisted billets from the
       Midway class to the Nimitz class of carriers.  These
       increases are due to the increase of aircraft on the
       larger Nimitz class carriers

Source:  Janes Fighting Ships 1980-1981 Edition, Franklin
         Watts Inc., New York, N.Y.

- Two fighter squadrons consisting of 24 F-4 Phantoms
  or F-14 Tomcats (at this time the F-4 Phantoms are
  being phased out and the F-14 Tomcat is the primary
  fighter aircraft; its SQMD will be used in this thesis
  for projected fighter squadron manpower requirements).

- Two light attack squadrons of 24 A-7 Corsairs. The
  A-7 Corsairs will start to be replaced by the F/A-18
  Hornet in FY 83, but the replacement rate may increase
  or decrease depending on the production of the new
  aircraft and whether or not the Oriskany (CV-34) is
  recommissioned. If the Oriskany (CV-34) is recom-
  missioned and Marine A-4 Skyhawks are used on it, this
  could step up introduction of the F/A-18 Hornet into
  the Navy [Ref. 24]. Because of the uncertainty of the
  plans and progress of the F/A-18 Hornet, all manpower
  requirements will be projected from the A-7 Corsair
  SQMD....(See Table V for schedule of phase out of A-4's
  and A-7's).

- One medium attack squadron of 12 A-6 Intruders and 4
  KA-6D tanker aircraft.

- One ASW squadron of 10 S-3 Scout aircraft.

- One ASW squadron of 6 SH-3 Sea King Helicopters for
  plane guard/ASW.

- Smaller squadrons or detachments of 3 RF-8-reconnais-
  sance aircraft. (At a later date, 2 F-14 Tomcats may
  be configured as photo reconnaissance aircraft.) Four
  EA-6B Prowler Electronic Warfare aircraft, and 4 E-2
  Hawkeye Early-Warning/Control aircraft.

The Midway class carriers cannot accommodate the full airwing
as described above, and normally would not operate the RF-8's,
one-half of the SH-3's (as cargo helicopters and possibly for
plane guard), or any of the S-3's [Ref. 25].

Based on this composition of a typical carrier airwing
force, an examination will be made of the officer require-
ments for each of the above squadrons using SQMD's. A sample
officer SQMD can be seen in Table VI. (All other relevant
officer SQMD's are in Appendix A.) Tables VII through IX

show the designator and grades for officers of various air-
wing compositions for a large carrier (Nimitz class).  Tables
X through XII show the designator and grades for officers of
various airwing compositions for a small carrier (Midway class).

TABLE V

F/A-18 REPLACEMENT (PHASE OUT) SCHEDULE

| SQUADRON | 83 | 84 | 85 | 86 | 87 |
|----------|----|----|----|----|----|
| F-4 USN | 2 | 2 | 0 | 0 | 0 |
| A-7 USN | 0 | 2 | 4 | 2 | 4 |
| F-4 USMC | 2 | 1 | 2 | 2 | 1 |
| A-4 USMC | 0 | 0 | 1 | 1 | 1 |
| Total | 4 | 5 | 7 | 7 | 7 |

Source:  NTP A-50-7703, Chief of Naval Operations
         OP-112D32.

The information in Tables VIII and XI was utilized in the
construction of Table XIII.  Table XIII shows the total air-
wing manpower requirements over the next decade.  This is
done in two ways.  First, sections A1, A2, A3 of Table XIII
utilize the assumption of two small carriers being in service
until FY 88, when two added Nimitz class carriers presently
being proposed by the Navy would come into service.  This,
of course, proposes that both carriers are funded by Congress
and are built at the same time.  Second, sections B1, B2 and

B3 of Table XIII calculate manpower projections based on
large carriers only. Table XIII, sections B1, B2 and B3,
will give a larger number of officer personnel required, but
could be more accurate than the numbers in sections A1, A2
and A3 because the small carriers often leave their excess
airwing personnel in strategic points ashore in case the
carrier has need of them quickly or a change in roles is
dictated [Ref. 26]. Although they are not on the carriers
as part of the airwing, the remaining aircraft and personnel
are on a standby basis and could be counted.

TABLE VI

AIRCRAFT SQUADRON MANPOWER DOCUMENT

A-6E/KA-6D OFFICER

10 A-6E/4KA-6D AIRCRAFT SQUADRON

| | | | | Rank | | | |
|------------|----|----|----|----|----|----|-------|
| Designator | W2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
| 130X       |    |    |    |    |    | 2  | 2     |
| 131X       |    |    | 14 | 5  | 2  |    | 21    |
| 132X       |    |    | 13 | 6  | 2  |    | 21    |
| 1520       |    |    |    |    | 1  |    | 1     |
| 1630       |    | 1  | 1  |    |    |    | 2     |
| 6330       |    |    |    | 1  |    |    | 1     |
| 7360       | 1  |    |    |    |    |    | 1     |
| 7380       | 1  |    |    |    |    |    | 1     |
| TOTAL      | 2  | 1  | 28 | 12 | 5  | 2  | 50    |

Source: OPNAVINST 5320.298A, Chief of Naval Operations
OP-111C2.

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TABLE VII

LARGE CARRIER AIRWING OFFICER PERSONNEL

(AIRWING CONSISTING OF (1)A-6, (2)A-7,
(1)E-2, (1)EA-6, (2)F-4, (1)S-3, (1)SH-3
and (1)RF-8 SQUADRONS)

| Designator | W-2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| 130X | | | | | | 12 | 12 |
| 131X | | | 88 | 54 | 27 | 8 | 177 |
| 132X | | | 74 | 30 | 14 | | 118 |
| 1520 | | 3 | | 6 | 3 | | 12 |
| 1630 | | 10 | 1 | | | | 11 |
| 3100 | | 1 | | | | | 1 |
| 6330 | | | | 2 | | | 2 |
| 6380 | | | | 1 | | | 1 |
| 7321 | 2 | | | | | | 2 |
| 7360 | 6 | | | | | | 6 |
| 7380 | 8 | | | | | | 8 |
| TOTAL | 16 | 14 | 163 | 93 | 44 | 20 | 350 |

Source:  Various OPNAVINST for squadrons listed above.

TABLE VIII

LARGE CARRIER AIRWING OFFICER PERSONNEL

(AIRWING CONSISTING OF
(1)A-6, (2)A-7, (1)E-2, (1)EA-6, (2)F-14,
(1)S-3, (1)SH-3 and (1)RF-8 SQUADRONS)

| Designator | W2 | 01 | 02 | Rank 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| 130X | | | | | | 12 | 12 |
| 131X | | | 90 | 52 | 27 | 8 | 177 |
| 132X | | | 74 | 30 | 14 | | 118 |
| 1520 | | 5 | | 4 | 5 | | 14 |
| 1630 | | 10 | 1 | | | | 11 |
| 3100 | | 3 | | | | | 3 |
| 6330 | | | | 2 | | | 2 |
| 6380 | | | | 3 | | | 3 |
| 7321 | 2 | | | | | | 2 |
| 7360 | 6 | | | | | | 6 |
| 7380 | 8 | | | | | | 8 |
| TOTAL | 16 | 18 | 165 | 91 | 46 | 20 | 356 |

Source: Various OPNAVINST for squadrons listed above.

TABLE IX

LARGE CARRIER AIRWING OFFICER PERSONNEL

(AIRWING CONSISTING OF

(1)A-6, (1)E-2, (1)EA-6, (2)F-14, (1)S-3,
(2)F/A-18, (1)SH-3 and (1)RF-8 SQUADRONS)

| Designator | W2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| 130X | | | | | | 12 | 12 |
| 131X | | | 92 | 46 | 27 | 8 | 173 |
| 132X | | | 74 | 31 | 14 | | 119 |
| 1520 | | 5 | | 4 | 5 | | 14 |
| 1630 | | 10 | 1 | | | | 11 |
| 3100 | | 3 | | | | | 3 |
| 6330 | | | | 2 | | | 2 |
| 6380 | | | | 3 | | | 3 |
| 7321 | 2 | | | | | | 2 |
| 7360 | 6 | | | | | | 6 |
| 7386 | 6 | | | | | | 6 |
| TOTAL | 14 | 18 | 167 | 86 | 46 | 20 | 351 |

Source:   Various OPNAVINST for squadrons listed above.

TABLE X

SMALL CARRIER AIRWING OFFICER PERSONNEL

(AIRWING CONSISTING OF (1)A-6, (2)A-7,

(1)E-2, (1)EA-6, (2)F-4 and (1)SH-3 SQUADRONS)

| Designator | W2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| 130X | | | | | | 10 | 10 |
| 131X | | | 62 | 38 | 19 | 5 | 124 |
| 132X | | | 58 | 21 | 11 | | 90 |
| 1520 | | 3 | | 6 | 1 | | 10 |
| 1630 | | 8 | 1 | | | | 9 |
| 6330 | | | | 1 | | | 1 |
| 6380 | | | | 1 | | | 1 |
| 7321 | 1 | | | | | | 1 |
| 7360 | 6 | | | | | | 6 |
| 7380 | 6 | | | | | | 6 |
| TOTAL | 13 | 11 | 121 | 67 | 31 | 15 | 258 |

Source: Various OPNAVINST for squadrons listed above.

TABLE XI

SMALL CARRIER AIRWING OFFICER PERSONNEL

(AIRWING CONSISTING OF (1)A-6, (2)A-7,

(1)E-2, (1)EA-6, (2)F-14, (1)SH-3 SQUADRONS)

| Designator | W2 | 01 | 02 | Rank 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| 130X | | | | | | 10 | 10 |
| 131X | | | 64 | 36 | 19 | 5 | 124 |
| 132X | | | 58 | 21 | 11 | | 90 |
| 1520 | | 5 | | 4 | 3 | | 12 |
| 1630 | | 8 | 1 | | | | 9 |
| 3100 | | 2 | | | | | 2 |
| 6330 | | | | 1 | | | 1 |
| 6380 | | | | 3 | | | 3 |
| 7321 | 1 | | | | | | 1 |
| 7360 | 6 | | | | | | 6 |
| 7380 | 6 | | | | | | 6 |
| TOTAL | 13 | 15 | 123 | 65 | 33 | 15 | 264 |

Source:  Various OPNAVINST for squadrons listed above.

TABLE XII

SMALL CARRIER AIRWING OFFICER PERSONNEL

(AIRWING CONSISTING OF (1)A-6, (1)EA-6,

(1)E-2, (2)F-14, (2)F/A-18, (1)SH-3 SQUADRONS)

| Designator | W2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| 130X | | | | | | 10 | 10 |
| 131X | | | 66 | 33 | 19 | 5 | 123 |
| 132X | | | 58 | 21 | 11 | | 90 |
| 1520 | | 5 | | 4 | 3 | | 12 |
| 1630 | | 8 | 1 | | | | 9 |
| 3100 | | 2 | | | | | 2 |
| 6330 | | | | 1 | | | 1 |
| 6380 | | | | 3 | | | 3 |
| 7321 | 1 | | | | | | 1 |
| 7360 | 6 | | | | | | 6 |
| 7380 | 4 | | | | | | 4 |
| TOTAL | 11 | 15 | 125 | 62 | 33 | 15 | 261 |

Source:  Various OPNAVINST for squadrons listed above.

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TABLE XIII

TOTAL AIRWING OFFICER FORCE FOR CARRIERS

(BOTH LARGE AND SMALL CARRIERS)[a]

Scenario A1

2 Small & 11 Large Carriers

FY 80 to FY 81

| Designator | W2 | O1 | O2 | O3 | O4 | O5 | TOTAL |
|---|---|---|---|---|---|---|---|
| 130X | | | | | | 152 | 152 |
| 131X | | | 1118 | 644 | 335 | 98 | 2195 |
| 132X | | | 930 | 372 | 176 | | 1478 |
| 1520 | | 65 | | 52 | 61 | | 178 |
| 1630 | | 120 | 13 | | | | 133 |
| 3100 | | 37 | | | | | 37 |
| 6330 | | | | 24 | | | 24 |
| 6380 | | | | 39 | | | 39 |
| 7321 | 24 | | | | | | 24 |
| 7360 | 78 | | | | | | 78 |
| 7380 | 100 | | | | | | 100 |
| TOTAL | 202 | 222 | 2061 | 1131 | 572 | 250 | 4438 |

Scenario B1

13 Large Carriers

FY 80 to FY 81

| Designator | W2 | O1 | O2 | O3 | O4 | O5 | TOTAL |
|---|---|---|---|---|---|---|---|
| 130X | | | | | | 156 | 156 |
| 131X | | | 1170 | 676 | 351 | 104 | 2301 |
| 132X | | | 962 | 390 | 182 | | 1534 |
| 1520 | | 65 | | 52 | 65 | | 182 |
| 1630 | | 130 | 13 | | | | 143 |
| 3100 | | 39 | | | | | 39 |
| 6330 | | | | 26 | | | 26 |
| 6380 | | | | 39 | | | 39 |
| 7321 | 26 | | | | | | 26 |
| 7360 | 78 | | | | | | 78 |
| 7380 | 104 | | | | | | 104 |
| TOTAL | 208 | 234 | 2145 | 1183 | 598 | 260 | 4628 |

[a]Large means Nimitz class and small means Midway class carriers.

Source: Compiled from Tables VIII and XI of this thesis.

TABLE XIII (continued)

Scenario A2
2 Small & 12 Large Carriers
FY 80 to FY 85

| Designator | W2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| | | | | Rank | | | |
| 130X | | | | | | 164 | 164 |
| 131X | | | 1208 | 696 | 362 | 106 | 2372 |
| 132X | | | 1004 | 402 | 190 | | 1596 |
| 1520 | | 70 | | 56 | 66 | | 192 |
| 1630 | | 129 | 14 | | | | 143 |
| 3100 | | 40 | | | | | 40 |
| 6330 | | | | 26 | | | 26 |
| 6390 | | | | 42 | | | 42 |
| 7321 | 26 | | | | | | 26 |
| 7360 | 84 | | | | | | 84 |
| 7380 | 108 | | | | | | 108 |
| TOTAL | 218 | 239 | 2226 | 1222 | 618 | 270 | 4793 |

Scenario B2
14 Large Carriers
FY 80 to FY 85

| Designator | W2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| | | | | Rank | | | |
| 130X | | | | | | 168 | 168 |
| 131X | | | 1260 | 728 | 378 | 112 | 2478 |
| 132X | | | 1036 | 420 | 196 | | 1652 |
| 1520 | | 70 | | 56 | 70 | | 196 |
| 1630 | | 140 | 14 | | | | 154 |
| 3100 | | 42 | | | | | 42 |
| 6330 | | | | 28 | | | 28 |
| 6390 | | | | 42 | | | 42 |
| 7321 | 28 | | | | | | 28 |
| 7360 | 84 | | | | | | 84 |
| 7380 | 112 | | | | | | 112 |
| TOTAL | 224 | 252 | 2310 | 1274 | 644 | 280 | 4984 |

Note: Large carriers means Nimitz class and small carriers means Midway class.

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TABLE XIII (continued)

### Scenario A3
2 Small & 13 Large Carriers
FY 80 to FY 88

| Designator | W2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| 130X | | | | | | 176 | 176 |
| 131X | | | 1298 | 748 | 389 | 114 | 2549 |
| 132X | | | 1078 | 432 | 204 | | 1714 |
| 1520 | | 75 | | 60 | 71 | | 206 |
| 1630 | | 139 | 15 | | | | 154 |
| 3100 | | 43 | | | | | 43 |
| 6300 | | | | 28 | | | 28 |
| 6380 | | | | 45 | | | 45 |
| 7321 | 28 | | | | | | 28 |
| 7360 | 90 | | | | | | 90 |
| 7380 | 116 | | | | | | 116 |
| TOTAL | 234 | 257 | 2391 | 1313 | 664 | 290 | 5149 |

### Scenario B3[b]
15 Large Carriers
FY 80 to FY 90

| Designator | W2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| 130X | | | | | | 180 | 180 |
| 131X | | | 1350 | 780 | 405 | 120 | 2655 |
| 132X | | | 1110 | 450 | 210 | | 1770 |
| 1520 | | 85 | | 68 | 81 | | 234 |
| 1630 | | 159 | 17 | | | | 176 |
| 3100 | | 49 | | | | | 49 |
| 6300 | | | | 32 | | | 32 |
| 6380 | | | | 51 | | | 51 |
| 7321 | 30 | | | | | | 30 |
| 7360 | 102 | | | | | | 102 |
| 7380 | 132 | | | | | | 132 |
| TOTAL | 264 | 293 | 2477 | 1381 | 696 | 300 | 5411 |

[a]Large means Nimitz class and small means Midway class carriers.
[b]Scenario B3 is the set of manpower requirements used in the remainder of this thesis.

Source: Compiled from Tables VIII and XI of this thesis.

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Section B3 of Table XIII was chosen to represent pro-
jected officer manpower requirements in this thesis because
of the following assumptions. The typical airwing composition
will be that of the large carrier airwing. This is so because
it seems obvious, in the light of the Navy's insistence on
continuing to commission Nimitz class carriers that the larger
airwings are the realistic projection for the next ten years,
besides being the "worst case" airwing manpower situation.
In addition to these factors, it has been previously shown
that smaller carriers, although carrying fewer aircraft on
board, still maintain the approximate airwing size of the
large carriers by leaving part of their assigned force ashore.

Table XIV reproduces Table XIII, Section B3, but gives
total number of billets plus a 30 percent increase for sea
and shore billets. These sea and shore billets are for avia-
tion personnel required to man positions other than airwing
billets [Ref. 27]. Air Department personnel for carriers,
flight instructors, recruiters and project managers are a
few examples of aviation billets that are included in the 30
percent factor. It is assumed in this thesis that the 30 per-
cent factor will be valid through 1990.

Table XV shows a sample of the enlisted manpower require-
ments from the same composite airwing as that used for officers.
(See Appendix B for all other enlisted SQMD's.) This informa-
tion was taken from the respective SQMD's, Table XV and all
other tables in this section pertaining to the enlisted manpower

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TABLE XIV

TOTAL AIRWING OFFICER FORCE FOR FIFTEEN LARGE CARRIERS
(30 PERCENT FACTOR ADDED)[a]

| | | | | Rank | | | |
|---|---|---|---|---|---|---|---|
| Designator | W2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
| 130X | | | | | | 234 | 234 |
| 131X | | | 1755 | 1014 | 537 | 156 | 3462 |
| 132X | | | 1443 | 585 | 273 | | 2301 |
| 1520 | | 111 | | 88 | 105 | | 304 |
| 1630 | | 207 | 22 | | | | 229 |
| 3100 | | 64 | | | | | 64 |
| 6300 | | | | 42 | | | 42 |
| 6380 | | | | 66 | | | 66 |
| 7321 | 39 | | | | | | 39 |
| 7360 | 133 | | | | | | 133 |
| 7380 | 172 | | | | | | 172 |
| TOTAL | 344 | 382 | 3220 | 1795 | 915 | 390 | 7046 |

Note: a. Standard factor for shore and sea billets other
than those billets required for squadron manning.


Source: Compiled from Table XIII, Section B3.

TABLE XV

AIRCRAFT SQUADRON MANPOWER DOCUMENT

A-6E/KA-6D ENLISTED

10 A-6E/4 KA-6D AIRCRAFT SQUADRON[a]

| Rating | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 | TOTAL |
|--------|-------|----|----|----|----|----|----|-------|
| AD  | 7   | 9  | 6  | 5  | 2  | 1  |    | 30  |
| AE  | 4   | 8  | 9  | 3  | 1  | 1  |    | 26  |
| AF  |     |    |    |    |    |    | 1  | 1   |
| AK  | 2   | 1  | 3  | 1  |    |    |    | 7   |
| AM  |     |    |    |    |    | 1  |    | 1   |
| AME | 2   | 2  | 4  | 2  |    |    |    | 10  |
| AMH | 2   | 3  | 4  | 3  |    |    |    | 12  |
| AMS | 7   | 7  | 3  | 4  | 2  |    |    | 23  |
| AN  | 56  |    |    |    |    |    |    | 56  |
| AO  | 8   | 7  | 5  | 4  | 1  |    |    | 25  |
| APO |     |    | 2  | 1  |    |    | 1  | 4   |
| AQ  | 4   | 9  | 11 | 3  | 1  | 1  |    | 29  |
| AT  | 4   | 7  | 9  | 3  |    | 1  |    | 24  |
| AZ  | 2   | 2  | 2  | 1  |    |    |    | 7   |
| DK  |     |    | 1  |    |    |    |    | 1   |
| HM  |     |    | 1  |    |    |    |    | 1   |
| IS  | 1   | 1  |    |    |    |    |    | 2   |
| MS  | 3   | 1  | 2  |    |    |    |    | 6   |
| NC  |     |    | 1  |    |    |    |    | 1   |
| PN  | 1   | 1  | 1  | 1  |    |    |    | 4   |
| PO  |     | 1  | 2  |    |    |    |    | 3   |
| PR  | 1   | 2  | 1  | 1  |    |    |    | 5   |
| SN  | 2   |    |    |    |    |    |    | 2   |
| YN  | 2   | 2  | 1  | 1  |    |    |    | 6   |
| TOTAL | 108 | 63 | 68 | 33 | 7 | 5 | 2 | 286 |

Note: a. This squadron would have 10 attack aircraft (A-6's)
and 4 tankers (KA-6D inflight refueling aircraft).

Source: OPNAVINST 5320.298A, Chief of Naval Operations OP-111C2.

force will show this force broken down by paygrade and rating. Table XVI shows the enlisted force for a small carrier, and Table XVII shows this breakdown for a large carrier, even though only the large carrier manpower will be used in the following tables. Tables XVIII and XIX are constructed to be congruent with the officer data in Table XIII, Section B3, and Table XIV. Tables XIV and XIX will be used in a manpower model in Chapter IV of this thesis.

TABLE XVI

SMALL CARRIER AIRWING ENLISTED PERSONNEL CONSISTING OF
(1)A-6, (2)A-7, (1)E-2, (1)EA-6B, (2)F-14 and (1)SH-3
SQUADRONS

| Rating | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 | TOTAL |
|--------|-------|-----|-----|-----|-----|-----|-----|-------|
| ABH    |       |     | 1   |     |     |     |     | 1     |
| AD     | 27    | 44  | 36  | 32  | 8   | 9   |     | 156   |
| AE     | 29    | 44  | 13  | 7   | 6   |     |     | 99    |
| AF     |       |     |     |     |     |     | 3   | 3     |
| AK     | 11    | 5   | 22  | 6   |     |     |     | 44    |
| AME    | 14    | 18  | 17  | 14  |     | 2   | 4   | 69    |
| AMH    | 23    | 26  | 24  | 18  | 5   |     |     | 96    |
| AMS    | 41    | 39  | 33  | 24  | 9   | 3   |     | 149   |
| AN     | 313   |     |     |     |     |     |     | 313   |
| AO     | 41    | 35  | 31  | 18  | 5   |     |     | 130   |
| APO    |       |     | 17  | 8   |     |     |     | 25    |
| AQ     | 20    | 33  | 41  | 11  | 5   | 5   |     | 115   |
| AT     | 33    | 69  | 74  | 17  | 10  | 8   |     | 211   |
| AV     |       |     |     |     |     |     | 5   | 5     |
| AZ     | 11    | 15  | 15  | 6   |     |     |     | 47    |
| DK     |       |     | 8   |     |     |     |     | 8     |
| HM     |       | 2   | 6   |     |     |     |     | 8     |
| IM     |       | 1   |     |     |     |     |     | 1     |
| IS     | 1     | 1   |     |     |     |     |     | 2     |
| MS     | 18    | 5   | 15  |     |     |     |     | 38    |
| NC     |       |     | 1   | 4   |     |     |     | 5     |
| OS     |       |     |     | 2   |     |     |     | 2     |
| PN     | 5     | 8   | 8   | 8   |     |     |     | 29    |
| PO     |       | 5   | 16  | 1   |     |     |     | 22    |
| PR     | 8     | 10  | 10  | 3   |     |     |     | 31    |
| SN     | 13    | 1   |     |     |     |     |     | 14    |
| YN     | 6     | 18  | 10  | 5   |     | 2   |     | 41    |
| TOTAL  | 614   | 379 | 398 | 184 | 48  | 29  | 12  | 1664  |

Source: Various OPNAVINST for squadrons listed above.

TABLE XVII

LARGE CARRIER AIRWING ENLISTED PERSONNEL CONSISTING OF
(1)A-6, (2)A-7, (1)E-2, (1)EA-6B, (2)F-14, (1)S-3,
(1)SH-3 and (1)RF-8 SQUADRONS

| Rating | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 | TOTAL |
|--------|-------|-----|-----|-----|-----|-----|-----|-------|
| ABH | | | 1 | | | | | 1 |
| AD | 36 | 58 | 44 | 39 | 11 | 11 | | 199 |
| AE | 41 | 55 | 54 | 19 | 8 | 8 | | 185 |
| AF | | | | | | | 4 | 4 |
| AK | 13 | 7 | 30 | 7 | | | | 57 |
| AM | | | | | | 2 | | 2 |
| AME | 18 | 23 | 21 | 17 | | 2 | 4 | 85 |
| AMH | 26 | 32 | 29 | 21 | 6 | | | 114 |
| AMS | 52 | 51 | 41 | 32 | 10 | 4 | | 190 |
| AN | 410 | | | | | | | 410 |
| AO | 48 | 38 | 34 | 32 | 8 | | | 160 |
| APO | | | 22 | 11 | | | 2 | 35 |
| AQ | 20 | 33 | 41 | 11 | 5 | 5 | | 115 |
| AT | 51 | 89 | 94 | 22 | 13 | 9 | | 278 |
| AV | | | | | | | 6 | 6 |
| AW | 13 | 11 | 12 | 4 | 3 | | | 43 |
| AX | 6 | 9 | 5 | 4 | 1 | 1 | | 26 |
| AZ | 14 | 20 | 20 | 8 | | | | 62 |
| DK | | | 10 | | | | | 10 |
| HM | | 2 | 8 | | | | | 10 |
| IM | | 2 | | | | | | 2 |
| IS | 1 | 1 | | | | | | 2 |
| MS | 21 | 7 | 20 | | | | | 48 |
| NC | | | 1 | 4 | | | | 5 |
| OS | | | | 2 | | | | 2 |
| PN | 7 | 10 | 10 | 9 | | | | 36 |
| PO | | 5 | 21 | 2 | | | | 28 |
| PR | 14 | 12 | 13 | 4 | | | | 43 |
| SN | 17 | 1 | | | | | | 18 |
| YN | 11 | 22 | 11 | 7 | | 2 | | 53 |
| TOTAL | 819 | 488 | 542 | 255 | 65 | 44 | 16 | 2229 |

Source: Various OPNAVINST for squadrons listed above.

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TABLE XVIII

TOTAL AIRWING ENLISTED FORCE FOR FIFTEEN LARGE CARRIERS

| Rating | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 | TOTAL |
|---|---|---|---|---|---|---|---|---|
| ABH | | | 15 | | | | | 15 |
| AD | 540 | 870 | 660 | 585 | 165 | 165 | | 2985 |
| AE | 615 | 825 | 810 | 285 | 120 | 120 | | 2775 |
| AF | | | | | | | 60 | 60 |
| AK | 195 | 105 | 450 | 105 | | | | 855 |
| AM | | | | | | 30 | | 30 |
| AME | 270 | 345 | 315 | 255 | | 30 | 60 | 1275 |
| AMH | 390 | 480 | 435 | 315 | 90 | | | 1710 |
| AMS | 780 | 765 | 615 | 480 | 150 | 60 | | 2850 |
| AN | 6150 | | | | | | | 6150 |
| AO | 720 | 570 | 510 | 480 | 120 | | | 2400 |
| APO | | | 330 | 165 | | | 30 | 525 |
| AQ | 300 | 495 | 615 | 165 | 75 | 75 | | 1725 |
| AT | 765 | 1335 | 1410 | 330 | 195 | 135 | | 4170 |
| AV | | | | | | | 90 | 90 |
| AW | 195 | 165 | 180 | 60 | 45 | | | 645 |
| AX | 90 | 135 | 75 | 60 | 15 | 15 | | 390 |
| AZ | 210 | 300 | 300 | 120 | | | | 930 |
| DK | | | 150 | | | | | 150 |
| HM | | 30 | 120 | | | | | 150 |
| IM | | 30 | | | | | | 30 |
| IS | 15 | 15 | | | | | | 30 |
| MS | 315 | 105 | 300 | | | | | 720 |
| NC | | | | 15 | 60 | | | 75 |
| OS | | | | | 30 | | | 30 |
| PN | 105 | 150 | 150 | 135 | | | | 540 |
| PO | | 75 | 315 | 30 | | | | 420 |
| PR | 210 | 180 | 195 | 60 | | | | 645 |
| SN | 255 | 15 | | | | | | 270 |
| YN | 165 | 330 | 165 | 105 | | 30 | | 795 |
| TOTAL | 12285 | 7320 | 8115 | 3750 | 1065 | 660 | 240 | 33435 |

Source:  Compiled from Table XVII

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TABLE XIX

TOTAL AIRWING ENLISTED FORCE FOR FIFTEEN LARGE CARRIERS
30 PERCENT FACTOR ADDED[a]

| Rating | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 | TOTAL |
|--------|-------|-----|------|------|------|-----|-----|-------|
| ABH | | | 20 | | | | | 20 |
| AD | 702 | 1131 | 858 | 761 | 215 | 215 | | 3882 |
| AE | 800 | 1073 | 1053 | 1141 | 156 | 156 | | 4379 |
| AF | | | | | | | 78 | 78 |
| AK | 254 | 137 | 585 | 137 | | | | 1113 |
| AM | | | | | | 39 | | 39 |
| AME | 351 | 449 | 410 | 332 | | 39 | 78 | 1659 |
| AMH | 507 | 624 | 566 | 410 | 117 | | | 2224 |
| AMS | 1014 | 1095 | 800 | 624 | 195 | 78 | | 3806 |
| AN | 7995 | | | | | | | 7995 |
| AO | 936 | 741 | 663 | 624 | 156 | | | 3120 |
| APO | | | 429 | 215 | | | 39 | 683 |
| AQ | 390 | 644 | 800 | 215 | 98 | 98 | | 2245 |
| AT | 895 | 1736 | 1833 | 429 | 254 | 176 | | 5323 |
| AV | | | | | | | 117 | 117 |
| AW | 254 | 215 | 234 | 78 | 59 | | | 840 |
| AX | 117 | 176 | 98 | 78 | 20 | 20 | | 509 |
| AZ | 273 | 390 | 390 | 156 | | | | 1209 |
| DK | | | 195 | | | | | 195 |
| HM | | 39 | 156 | | | | | 195 |
| IM | | 39 | | | | | | 39 |
| IS | 20 | 20 | | | | | | 40 |
| MS | 410 | 137 | 410 | | | | | 957 |
| NC | | | | 20 | 78 | | | 98 |
| OS | | | | | 39 | | | 39 |
| PN | 137 | 195 | 195 | 176 | | | | 703 |
| PO | | 98 | 410 | 39 | | | | 547 |
| PR | 273 | 234 | 254 | 78 | | | | 839 |
| SN | 332 | 20 | | | | | | 352 |
| YN | 215 | 429 | 215 | 137 | | 39 | | 1035 |
| TOTAL | 15875 | 9622 | 10574 | 5650 | 1387 | 860 | 312 | 44280 |

Note: a. Standard factor for shore and sea billets other
than those billets required for squadron manning.

Source: Compiled from Table XVIII.

# III. ATTRITION AND RETENTION

A problem of manpower shortages faces today's Navy, particularly among middle grade officers (Lieutenant (LT) and Lieutenant Commanders (LCDR)), and among the experienced petty officers grades (E-5 through E-9) [Ref. 28]. At the present time, the Navy has about 35 percent fewer pilots than it needs and is short approximately 21,000 experienced petty officers [Ref. 29]. Art Buchwald, a satirist, wrote a column titled "Anchors Aweigh," which stated the following:

> The United States is giving in to a crash program to build up its military might. We want to be in a position to match the Soviets on land, on sea and in the air. There is only one problem. Once we get all the new helicopters, planes and ships built, where do we find the people to man them?
>
> The Navy, for example, does not have enough crewmen to handle the ships they're supposed to keep on the high seas now. [Ref. 30]

Time magazine published an article "Who'll Fight for America?" From this article the following examples are quoted:

> For all of its sophisticated weaponry, America is facing a shortage of the most valuable military resource of all: Manpower.
>
> Today, however, a career in the armed forces is not attracting enough talented Americans. The Pentagon is handicapped by shortages of sufficiently skilled and disciplined personnel in all ranks.
>
> And Joint Chiefs of Staff chairman David C. Jones admits that "Our No. 1 readiness problem is people, the availability of trained people." [Ref. 31]

An article which relates more closely to the manpower problem which this thesis addresses was written by syndicated columnist Jack Anderson:

> Two 90,000 ton nuclear-powered aircraft carriers are proposed in the president's budget, and the twelve-carrier fleet is to be expanded eventually to fifteen.
>
> But the trouble is, the Navy is finding it tough to hang onto enough pilots to man its present carrier strength much less those who'll be needed to fly the planes from an increased flattop fleet.
>
> Last year, 436 Navy pilots quit. The Navy wound up twenty-five percent short in pilots of commander rank and below--the ones who would be most tempted by commercial airline jobs. The Navy needed almost 13,000 pilots; it had only 9,000, and this of course is before any new carriers are built. [Ref. 32]

As can be seen from the above articles, the Navy is perceived as having a manpower problem, both with its aviation officers and with its enlisted personnel, particularly those in the middle grades and ranks.

There is some expectation that the aviation-officer manpower problem will not get better for some time to come. The demand from the airlines for aviators for the next six to eight years has been estimated to be between 1,000 and 1,200 pilots a year. A primary reason for this large number of pilot vacancies is that the WW II era pilots who have held positions with the airlines are now at retirement age. Also, there is an expected growth of the airlines to accommodate approximately 860 new pilots, bringing this total demand for pilots by the airlines to about 1,900 per year through the middle to late 1980's [Ref. 33]. When this 1,900 per year

pilot need for commercial airlines is compared to the expected growth in the pilot requirements for the Navy, one can expect that the Navy's pilot shortage may continue, if not in fact increase. At the present time, the combined Navy and Air Force pilot training rate is only 2,075 per year [Ref. 34]. Currently, approximately 80 percent of the pilots hired by the airlines were previously military pilots [Ref. 35]. This does not take into consideration the growth or requirements for pilots in general aviation which cause the 1,900 number to increase. Of the 1,520 pilots (80 percent of the total 1,900 airline hirings projected yearly), the Air Force supplies one-half and the Navy supplies the other half. In other words, the Navy supplies, or will most likely supply, approximately 760 pilots per year to the airlines [Ref. 36]. From these facts, it can be seen that the military will have a difficult time meeting its requirements for pilots.

These figures are of course subject to change in the future as unforeseen developments take place. The recent Professional Air Traffic Controllers Organization (PATCO) action, which has caused a number of pilot layoffs, is a prime example of how the projected picture can be altered. Nevertheless, despite the temporary ebb and flow in demand, overall projections still call for increased hiring by civil aviation.

A. AVIATION OFFICER RETENTION

The Navy's aviation officer community consists of two distinct groups: the pilot (1310/5 designator), and the Naval

Flight Officer (NFO) (1320/5 designator). The pilot's role is self-explanatory. But the NFO, on the other hand, performs a variety of jobs. The NFO may be a navigator, weapons system operator, electronic-counter-measures operator, or fill any other job requiring an officer that does not involve piloting of the aircraft, but does involve flying in an aircraft.

Pilots and NFO's also face different demand curves in the outside job market. The military pilot sees, during many periods, a high demand by the commercial airlines. An NFO, since he does not handle the airplane itself, but instead handles the electronic equipment, does not have this demand for his services. Because of the demand difference, there is a difference between pilot and NFO retention rates, i.e., the NFO has a higher retention rate than does the pilot. Figure 5 shows that the pilots leave the service at a much greater rate than do the NFO's [Ref. 37]. The NFO's higher retention rate has helped the Navy to some extent, in that the NFO has been used to fill jobs formerly given to pilots.

Another problem tied to low retention is that pilots are needed to train pilots and NFO's. Therefore, if pilots are taken away from sea-going squadrons to fill training billets, this increases the shortage of pilots at sea. Also, placing pilots in training roles may decrease retention because pilots don't want to be assigned to flight-instructor billets, since flight-instructor billets are perceived to be of a lower status than are sea-going squadron billets [Ref. 38].

RETENTION TRENDS OF PILOTS AND NAVAL FLIGHT OFFICERS
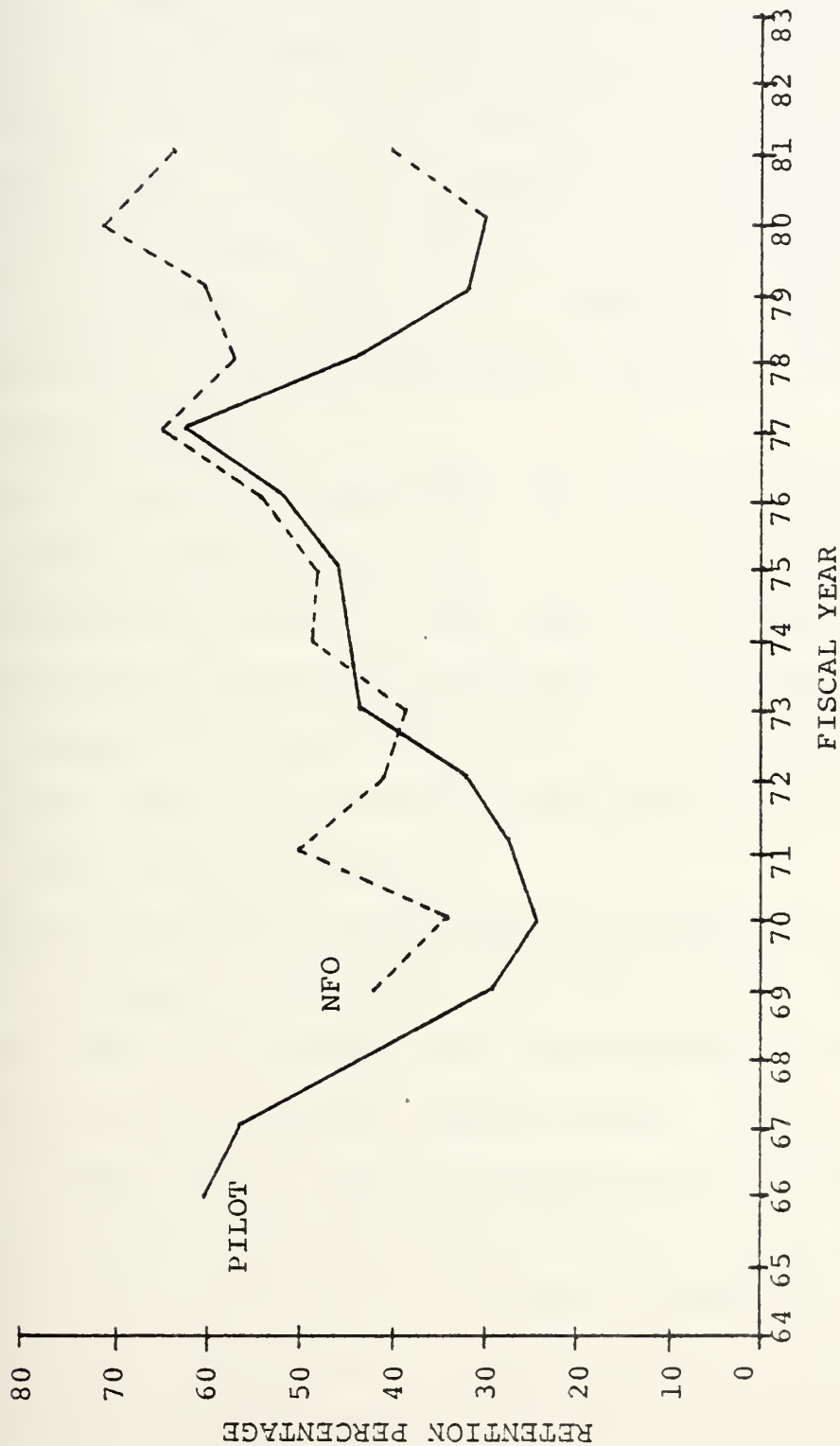


FISCAL YEAR

Figure 5

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# B. AVIATION OFFICER ATTRITION

It is not possible to determine the feasibility of manning the aviation wings of the fifteen carrier force without considering all of the factors which influence the final numbers of personnel required. It must therefore be recognized that retention is only a part of the problem. An equally important factor is the attrition rate which acts to determine the total number of personnel who must be attracted to a given designator in order to realize the required numbers of personnel (all billets filled).

Table XX shows the programmed and actual training production of Navy pilots from FY 75 to FY 80, and Table XXI shows this information for NFO's. When the totals of Table XX are compared with the 760 pilots per year the Navy has supplied to the airlines, one can see that the Navy is producing a few more pilots than the airlines projected they would hire prior to the PATCO action in mid-1981.

Tables XX and XXI show the number who made it through training compared to the number the Navy wanted. The figures in these tables (XX and XXI) show the difference between requirements met and actual numbers needed. (Where the goal of 100 percent was met, the estimated aviation student attrition rate was correct, but, where the percentage was below 100, the Navy's attrition of aviation students was higher than expected. Conversely, if the percentage is above 100, the aviation students attrited at a lower rate than expected.)

TABLE XX

CHIEF OF NAVAL AIR TRAINING PRODUCTION OF PILOTS
FOR FY 75 - FY 80

Programmed/Actual
and Percentage

| YEAR | JET | PROP | HELO | TOTAL |
|------|-----|------|------|-------|
| FY 75 | 319/332 | 427/415 | 230/177 | 976/924 |
| | 104% | 97% | 77% | 95% |
| FY 76 | 340/324 | 375/375 | 205/205 | 920/904 |
| | 98% | 100% | 100% | 98% |
| FY 77TQ[a] | 87/81 | 83/81 | 55/55 | 225/217 |
| | 93% | 98% | 100% | 96% |
| FY 77 | 372/346 | 340/325 | 188/144 | 900/744 |
| | 93% | 75% | 77% | 83% |
| FY 78 | 335/276 | 270/182 | 195/139 | 800/597 |
| | 82% | 67% | 71% | 75% |
| FY 79 | 375/208 | 295/208 | 215/116 | 885/532 |
| | 56% | 71% | 54% | 60% |
| FY 80 | 318/320 | 316/320 | 251/251 | 885/891 |
| | 101% | 101% | 100% | 101% |

Note:  a.  TQ is July 1 through September 30.

Source:  Department of the Navy, Chief of Naval Air Training
OP-591D.

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TABLE XXI

CHIEF OF NAVAL AIR TRAINING PRODUCTION OF NFO'S
FOR FY 75 - FY 80

Programmed/Actual
and Percentage

| YEAR | TJN[a] | RIO[b] | ATDS[c] | NAV[d] | TOTAL |
|------|--------|--------|---------|--------|-------|
| FY 75 | 52/44 | 85/74 | 43/21 | 172/172 | 361/322 |
|  | 85% | 88% | 49% | 100% | 89% |
| FY 76 | 169/150 | 79/59 | 22/23 | 190/190 | 460/422 |
|  | 88% | 74% | 104% | 100% | 91% |
| FY 77TQ[e] | 43/43 | 10/10 | 12/16 | 50/50 | 115/119 |
|  | 100% | 100% | 133% | 100% | 103% |
| FY 77 | 142/142 | 74/74 | 40/40 | 184/186 | 440/442 |
|  | 100% | 100% | 100% | 101% | 101% |
| FY 78 | 142/133 | 98/90 | 30/30 | 190/172 | 460/425 |
|  | 95% | 92% | 100% | 91% | 92% |
| FY 79 | 130/121 | 78/72 | 37/37 | 205/179 | 450/409 |
|  | 93% | 92% | 100% | 87% | 91% |
| FY 80 | 130/130 | 74/74 | 41/41 | 205/206 | 450/451 |
|  | 100% | 100% | 100% | 101% | 101% |

Notes:  a.  Tactical Jet Navigator, A-6's,S-3's aircraft.
        b.  Radar Intercept Officer, F-4's,F-14's aircraft.
        c.  Airborne Tactical Data Systems, EA-6's & E2-C
            aircraft.
        d.  Navigator, P-3, aircraft.
        e.  TQ is July 1 through September 30, 1977.

Source: Department of the Navy, Chief of Naval Air Training,
        OP-591D.

Those who did not complete training and either left the service or selected another designator (not aviation) are not included in these figures. Figure 6 shows attrition rates during training for pilots, and Figure 7 shows the rates for NFO's. Taking the average attrition rates over the years (shown in Figures 6 and 7), one finds a 28 percent attrition rate for pilots and a 29 percent attrition rate for NFO's. If the 28 percent attrition rate from pilot training is subtracted from 100 percent entering training, the resultant figure, when multiplied by the 30 percent pilot retention figure for FY 80, indicates that the Navy would need approximately five college graduates starting flight training in order to ultimately fill every junior officer billet required up to the LCDR (04) level. And this would only keep the pilot force (up to LCDR) at today's strength, which is 25 to 35 percent below what is required [Ref. 39]. Performing the same computations for NFO's shows that the Navy would only need two college graduates for every NFO billet (up to LCDR) requirement. These calculations do not take into account deaths or those officers who are passed over twice and are forced to leave the service, but it does include those few officers who choose to leave after the ten-year point. (Because the number of officers who leave the Navy after the ten-year point is so small, the full 30 percent attrition rate was assigned to the first opportunity period.)

Table XXII shows historical promotion results for pilots and NFO's. It can be seen that the promotion rates have

STUDENT PILOT ATTRITION RATES, FY 62 - FY 79
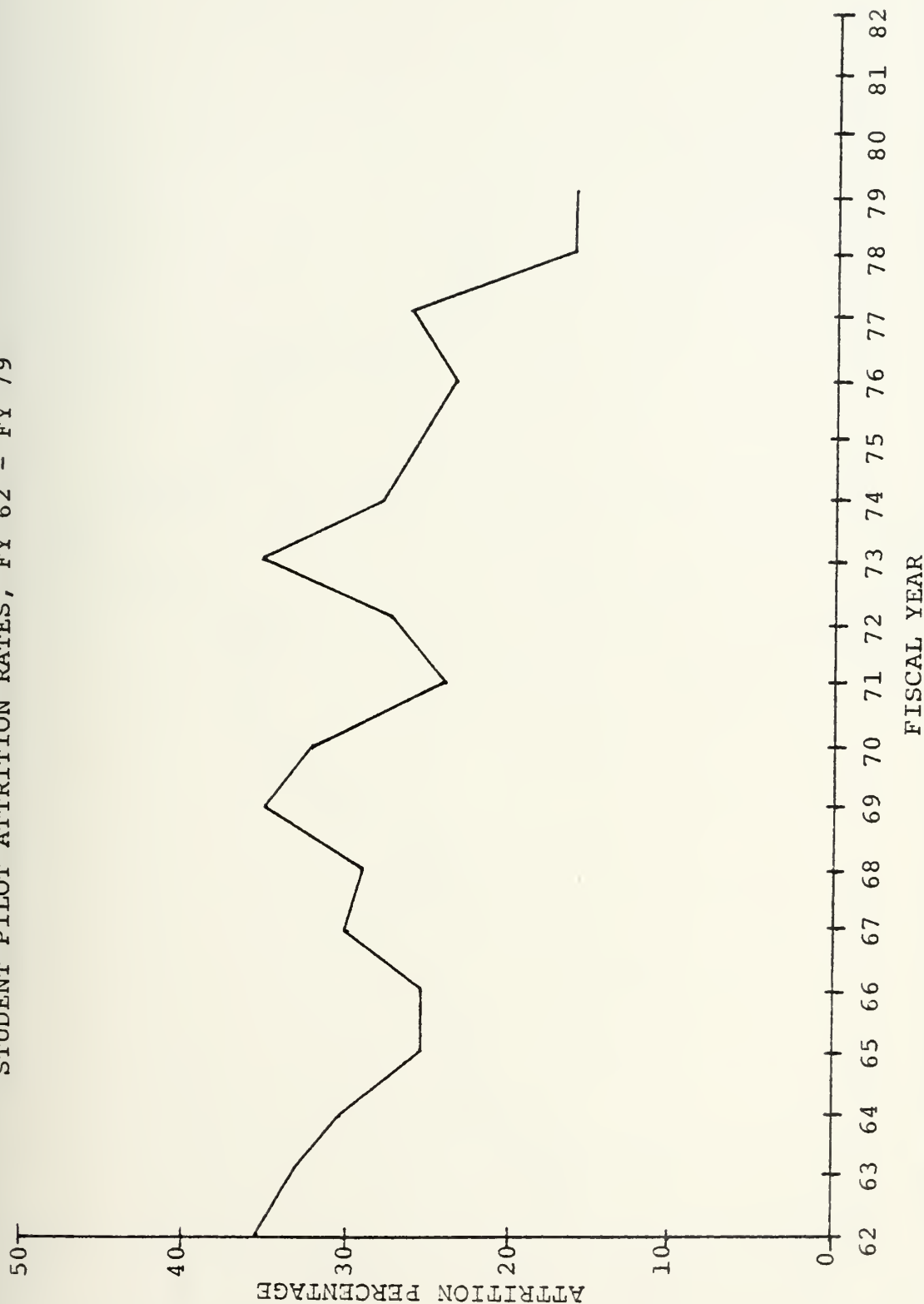


FISCAL YEAR

Source: Naval Aviation Attrition 1950-1976: Implications for the Development of Future Research and Evaluation, Griffin, G.R. & Mosko, J.D., Naval Aerospace Medical Research Lab. NAMRL-1237; and Department of the Navy, Chief of Naval Air Training, OP-591D.

Figure 6

STUDENT NFO ATTRITION RATES, FY 62 - FY 79
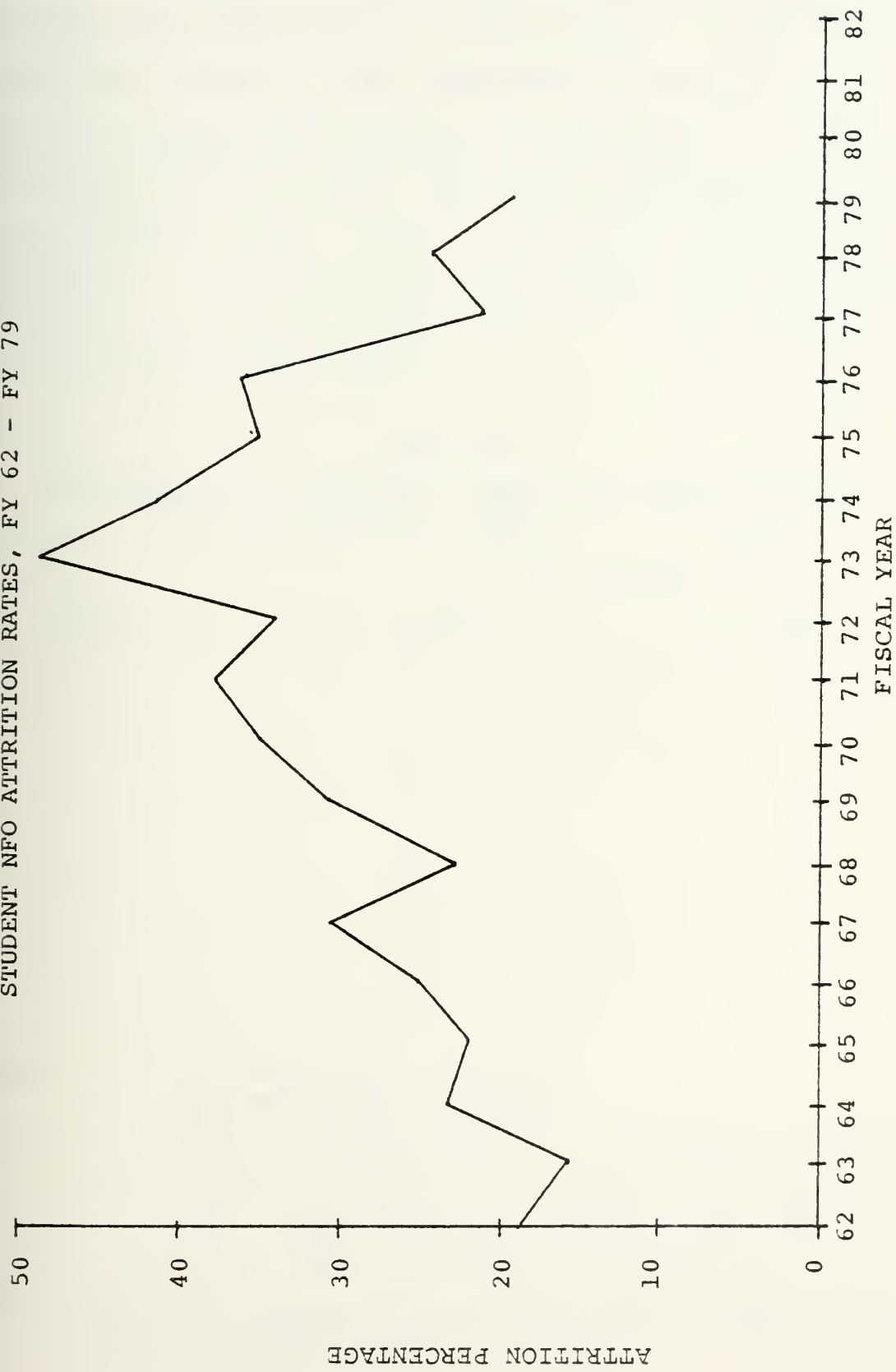
ATTRITION PERCENTAGE

FISCAL YEAR

Source: Naval Aviation Attrition 1950-1976: Implications for the Development of Future Research and Evaluation, Griffin, G.R. & Mosko, J.D., Naval Aerospace Medical Research Lab. NAMRL-1237; and Department of the Navy, Chief of Naval Air Training, OP-591D.

Figure 7

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increased as the retention rates have decreased. Because

the promotion rates are not at 100 percent, we can assume

some pilots and NFO's leave the service because they have

failed to be selected to the next higher rank. It cannot be

determined from this table (Table XXII) what percentage of

pilots and NFO's left the Navy after being passed over for

promotion, so attrition rates will only be calculated for

the training-attrition data.

TABLE XXII

LIEUTENANT TO LIEUTENANT COMMANDER PROMOTION RATES
FOR PILOT AND NFO'S FROM FY 73 - FY 79

| | Percentage | |
|---|---|---|
| YEAR | 1310[a] | 1320[b] |
| FY 73 | .87 | .65 |
| FY 74 | .75 | .76 |
| FY 75 | .75 | .76 |
| FY 76 | .67 | .65 |
| FY 77 | .82 | .83 |
| FY 78 | .85 | .83 |
| FY 79 | .97 | 1.11[c] |

Notes:  a.  1310 Designator for pilots.
        b.  1320 Designator for NFO's.
        c.  Selection percentages are defined as the total
            number of selectees above, below and in zone
            divided by the number of officers eligible in the
            zone. A percentage of greater than 100% is
            obtained when the number of all selectees is
            greater than the number of in zone eligibles.

Source: Officer Promotion Opportunity within the Navy Unre-
        stricted Line 1973-1979, Hansell, R.C., Naval Post-
        graduate School Thesis, June 1979.

Later in this thesis the aviation personnel attrition and retention data will be coupled with other data for use in a requirements vs. inventory model.

C.  ENLISTED ATTRITION AND RETENTION

This section will deal with eleven categories of enlisted personnel working in Naval aviation.  There are more than eleven categories for enlisted ratings within the Navy, but we are only concerned with those that have a direct impact on the aviation side of the Navy.  The personnel in the following ratings deal primarily with aircraft, and specifically the maintenance of aircraft:  PR, AD, AE, AME, AMH, AMS, AO, AQ, AT, AW and AX (see Appendix C for explanation of ratings). There are other ratings that have an A prefix, but they are only involved in paper work, work at shore based installations only, or are not assigned to a squadron, i.e., AB, ABE, ABF, AG, AS, ASE, ASH, and AVS personnel are not assigned to a squadron.  AZ and AK personnel are assigned to squadrons, but they do not perform maintenance on aircraft.  The PR rating, even though not prefixed with an A, is assigned to squadrons and does work on equipment for the aircraft as well as on the survival equipment for the aviators.  The PR rating is therefore included in this study.

The enlisted ratings chosen are all on the Career Reenlistment Objectives (CREO) list in Table XXIII [Ref. 40]. Table XXIII shows that the  aviation ratings are in demand by the Navy.  Translated, this means that an individual with

TABLE XXIII

CAREER REENLISTMENT OBJECTIVES (CREO) CATEGORIES

| Rating | CREO Category | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 |
|--------|---------------|-------|-----|-----|-----|-----|-----|-----|
| AQ | A | $0^b$ | A | A | B | C | B | $-^c$ |
| AE | B | 0 | B | B | C | C | A | - |
| AT | B | 0 | A | B | C | C | B | - |
| AW | B | 0 | A | B | B | C | C | C |
| AD | C | 0 | C | B | C | C | C | - |
| AME | C | $cl^d$ | C | C | C | C | - | - |
| AMH | C | 0 | D | B | C | D | - | - |
| AMS | C | 0 | D | B | C | D | - | - |
| AO | C | 0 | C | C | C | C | C | B |
| AX | C | 0 | C | C | C | D | B | - |
| PR | C | cl | C | C | C | C | C | A |

Notes:  a.  See Appendix C for explanation of ratings.

b.  0 means that there are no requirements at this level.

c.  No requirements at this paygrade.

d.  These ratings closed for reenlistment at this paygrade level.

An A means that there is a high demand for personnel in a rating and a D means that the demand is less.

Source: Career Reenlistment Objectives, OPNAVINST 1133.3, 8 January 1980.

a rating on the CREO list has a very good opportunity to reenlist, should he so desire. Also, variable reenlistment bonuses are tied to the CREO list. (The alphabetical code A means there is a strong need for people to reenlist in that rating and D means there is a lesser need. If the code (cl) appears, it indicates that a particular rating area is filled, and no individual of that rating (usually tied to a specific paygrade) can reenlist in that rating. If the person wants to reenlist he would have to change ratings.) One can also ascertain from Table XXIII that there is a larger need of ratings in the E-4 through the E-6 paygrades, i.e., the middle paygrades.

One of the recent theses completed at the Naval Postgraduate School addressed attrition severity [Ref. 41]. In that thesis, data were gathered to show shortages or excesses of personnel in U.S. Navy ratings. Data for those ratings that are relevant to aviation are shown in Table XXIV. As one can see, there seems to be an overage in almost all ratings except AO's, the billets of which were filled to the exact amount required. Table XXIV takes into account paygrades E-3 through E-9. (The Navy has no formal billet requirements for E-1 and E-2 paygrades. These requirements are usually covered and encompassed by the E-3 paygrade.) Thus, the picture created by Table XXIV gives the impression that the Navy does not have an enlisted aviation manpower problem. This may be true as far as total numbers go, but, if Table XXV is examined, it

## TABLE XXIV

### SIZE AND SHORTAGE OR EXCESS OF REQUIREMENTS
### FOR U.S. NAVY AVIATION RATINGS

| Rating[a] | Size[b] | Shortage/Excess[c] |
|-----------|---------|--------------------|
| AD        | 6,613   | .00                |
| AE        | 3,264   | .15                |
| AME       | 1,487   | .07                |
| AMH       | 2,913   | .05                |
| AMS       | 4,254   | .08                |
| AO        | 3,096   | .17                |
| AQ        | 892     | .28                |
| AT        | 3,612   | .14                |
| AW        | 1,208   | .11                |
| AX        | 734     | .08                |
| PR        | 977     | .12                |

Notes:  a.  See Appendix C for rating names.

b.  Size equals inventory.

c.  Shortage or excess equals (requirements minus inventory) divided by requirements.

Source: Fourth Quarter FY 80 Navy Military Personnel Statistics.

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can be seen that there is an overage in the E-1 to E-3 pay-
grades, while paygrades E-4 through E-9 have a shortage, and
there are large shortages in the E-5 and E-9 paygrades. So,
by noting the shortages of the middle-grade enlisted pay-
grades shown in Table XXV, one can determine that the Navy
does, in fact, have an enlisted aviation manpower problem.

TABLE XXV

NAVY ENLISTED MANNING STATUS, 1981,
BY PAYGRADE

| Paygrade | Billet Requirement | Current Number | Shortages Percentage |
|---|---|---|---|
| E1-E3 | 168,667 | 172,246 | 102[a] |
| E4 | 104,825 | 98,852 | 6 |
| E5 | 100,455 | 80,107 | 20 |
| E6 | 78,831 | 66,447 | 16 |
| E7 | 33,483 | 29,199 | 13 |
| E8 | 9,799 | 8,378 | 15 |
| E9 | 4,154 | 3,224 | 22 |

Note: a. E1-E3 has an overage, all others are shortages.

Source: These data were gathered from various sources and
were presented in a manpower class, MN 4106 MPT
Policy Analysis, in June 1981. The course addressed
the question of how to man a 600-ship Navy.

Attrition of first-term Navy enlisted personnel has
increased substantially from rates observed in the mid-1960's.
In 1966, total premature loss after two years was 10 percent
of accessions. That number had risen to 29 percent by 1976.
Losses by the fourth year of enlistment increased from 17
percent in 1966 to 41 percent by 1976. [Ref. 42]

Table XXVI shows the reenlistment opportunity (at entry)
for grouped aviation ratings in 1979 [Ref. 43]. Even though
the Navy only attrites approximately 24 to 27 percent of its
enlisted aviation force in four years of service (as shown
in Table XXVI), the chances of reenlisting an individual are
small.

Table XXVII shows the reenlistment rates for all ratings.
In comparing Tables XXVI and XXVII, it can be seen that the
Navy has more problems in retaining aviation personnel at the
first reenlistment opportunity than it does in retaining
personnel in most other ratings that do not involve aviation.

Table XXVIII shows attrition and retention rates Navy-
wide. These data were gathered for a project at the Naval
Postgraduate School in which the billet requirements for a
600-ship Navy were forecasted.

The last table (Table XXIX) of this section was derived
from the Naval Military Personnel Command (NMPC-DSS), Navy
Military Personnel Statistics [Ref. 44]. Table XXIX includes
attrition and retention percentages for all aviation ratings
included in this study. Paygrade will be assumed by length

TABLE XXVI

NAVY FIRST TERM REENLISTMENT CHANCES (AT ENTRY)
BY RATING/GROUP (IN PERCENTAGE)

| AVWEP[a] | Four Year Survival Chance | Reenlistment Chance if Survived | Retention Chance at Entry |
|---|---|---|---|
| AT,AW,AQ, AC,AX | 76 | 16 | 12 |

| AVM[a] | Four Year Survival Chance | Reenlistment Chance if Survived | Retention Chance at Entry |
|---|---|---|---|
| AM,AD, AE,AO | 73 | 22 | 16 |

Note:   a.   AVWEP and AVM are names for composite groups of
             ratings.

Source:   First Term Survival and Reenlistment Chances for Navy
          Ratings and a Strategy for Their Use.   Thomason,
          James S., Center for Naval Analyses (CRC 382), May
          1979.


TABLE XXVII

FIRST TERM NAVY ENLISTED RETENTION RATES,
FY 71 TO FY 79

| ACTUAL | | | | ESTIMATED | | | PROJECTED | |
|---|---|---|---|---|---|---|---|---|
| FY 71 | FY 72 | FY 73 | FY 74 | FY 75 | FY 76 | FY 77 | FY 78 | FY 79 |
| 28 | 32 | 34 | 38 | 32 | 35 | 38 | 31 | 28 |

Source:   American Volunteers:  A Report on the All-Volunteer
          Armed Forces, Office of the Assistant Secretary of
          Defense (Manpower, Reserve Affairs and Logistics),
          31 December 1978.

TABLE XXVIII

NAVY ATTRITION AND RETENTION STATISTICS,
FY 81 (TO JUNE 1981)

| | |
|---|---|
| 1st Term Attrition | 26 percent |
| 1st Term Retention | 31 percent |
| 2nd Term Retention | 55 percent |
| 3rd Term Retention | 64 percent |

Source:   These data were gathered from various sources and
          were presented in a manpower class, MN 4106 MPT
          Policy Analysis, in June 1981.  The course addressed
          the question of how to man a 600-ship Navy.


of service, i.e., length of service time from E-1 to E-2 will
be assumed to be six months; from E-2 to E-3, six months;
time from E-3 to E-4 will be assumed to be one year (but
could be as little as nine months); E-4 to E-5, one year; E-5
to E-6, three years; and three years from E-6 to E-7, E-7 to
E-8, and E-8 to E-9.  These are the minimum times for an in-
dividual to be eligible for promotion to the next higher grade.

     The data set forth in this chapter have addressed three
areas (attrition, retention, and promotion) affecting ultimate
numbers of personnel available, both officer and enlisted, in
the Naval aviation community.  The data will be the basis for
the transition matrix to be used in a Markov Chain model in
Chapter IV of this thesis.  The model will be used to estab-
lish projections of numbers of personnel required to fill
billets for a projected fifteen carrier airwing force by 1990.

TABLE XXIX

ENLISTED CONTINUATION RATES FOR NAVY
AVIATION ENLISTED PERSONNEL

| Year of Service | AD | AE | AME | AMH | AMS | AO |
|---|---|---|---|---|---|---|
| 1. | .9478 | .9998 | .9998 | .9287 | .9341 | .9746 |
| 2. | .7969 | .9133 | .9293 | .8250 | .8285 | .8187 |
| 3. | .6402 | .7523 | .8091 | .6567 | .6489 | .6401 |
| 4. | .2870 | .3567 | .3733 | .3403 | .3228 | .3097 |
| 5. | .2674 | .3373 | .3515 | .3190 | .2992 | .3018 |
| 6. | .2418 | .2973 | .3206 | .2916 | .2690 | .2565 |
| 7. | .2285 | .2722 | .2942 | .2723 | .2525 | .2405 |
| 8. | .2094 | .2352 | .2543 | .2439 | .2321 | .2194 |
| 9. | .1933 | .2120 | .2115 | .2199 | .2075 | .2031 |
| 10. | .1783 | .1910 | .1994 | .1978 | .1821 | .1800 |

| Year of Service | AQ | AT | AW | AX | PR |
|---|---|---|---|---|---|
| 1. | .9998 | .9998 | .9998 | .9998 | .9998 |
| 2. | .9250 | .9174 | .9212 | .9573 | .9137 |
| 3. | .8163 | .7852 | .7707 | .8076 | .7937 |
| 4. | .5611 | .5380 | .3795 | .5296 | .4044 |
| 5. | .5306 | .5170 | .3732 | .5287 | .3969 |
| 6. | .3745 | .3958 | .3207 | .4594 | .3666 |
| 7. | .3236 | .3649 | .2897 | .4407 | .3401 |
| 8. | .2554 | .3066 | .2432 | .4049 | .3158 |
| 9. | .1782 | .2537 | .2185 | .3756 | .3121 |
| 10. | .1333 | .2241 | .2185 | .3571 | .2691 |

Note:  The data go up to thirty years of service, but only
ten years of data are needed for calculations in
Chapter IV.

Source:  Naval Military Personnel Commands (NMPS-DSS), Navy
Military Personnel Statistics, dated 17 March 1981.

## IV.  MANPOWER PROJECTIONS (MARKOV CHAIN MODEL MANMOD)

In this chapter a program named MANMOD, which is based on a Markov Chain model, will be used to predict officer and enlisted manpower accession and retention requirements for a fifteen carrier force.  These predictions will be based on rank for the two aviation officer designators and on pay-grade for the eleven enlisted aviation ratings used.  The period of time covered will be from present day to FY 1990.

To understand this section, a simple explanation of a Markov Chain model is in order.  The first assumption of a Markov Chain model is that an individual will move from one time period to the next independently of other individuals, and with identical probabilities which do not vary over time [Ref. 45].  Secondly, each person has a given probability of making any particular transition [Ref. 46].  These probabilities of transition are arranged in an array as follows:

$$
\begin{array}{cccccccccc}
P_{11} & P_{12} & P_{13} & \cdots & \cdots & \cdots & \cdots & \cdots & P_{1k} & W_{1} \\
P_{21} & P_{22} & P_{23} & \cdots & \cdots & \cdots & \cdots & \cdots & P_{2k} & W_{2} \\
\cdot & \cdot & \cdot & & & & & & & \cdot \\
\cdot & \cdot & \cdot & & & & & & & \cdot \\
\cdot & \cdot & \cdot & & & & & & & \cdot \\
P_{k1} & P_{k2} & P_{k3} & \cdots & \cdots & \cdots & \cdots & \cdots & P_{kk} & W_{k}
\end{array}
$$

where the element $P_{ij}$ is the probability that an individual

in grade at the beginning of an interval of time will move
to grade j at the end of that time interval, while $W_i$ is the
probability that an individual of grade i at the start has
left the Navy by the end of the interval. Another assumption
is that each person must stay where he is, move to another
grade, or leave [Ref. 47]. The row sums for each row must
equal one, i.e.,

$$P_{11} + P_{12} + P_{13} \cdots\cdots\cdots + P_{1k}$$

The matrix P = $)p_{ij})$ is the transition matrix and the column
vector W = $(w_1, w_2, w_3, \ldots w_k)$ is known as the wastage vec-
tor [Ref. 48]. It is implicit in this model that time is
discrete. In practice, the unit of time will be a year or a
month. (In this thesis all periods are yearly.) All the P
and W elements will be assigned numerical values using esti-
mates of probabilities from past data. To use this model,
one also needs information on the initial stock vector (N = $n_1$,
$n_2$, $n_3$,...$n_k$). At any time an individual can be classified
into a group on the basis of whatever attributes are relevant.
Finally, a recruitment vector (R = $r_1$, $r_2$, $r_3$,...$r_k$) is used
to replenish the stocks (N) [Ref. 49].

This model, Markov Chain (MANMOD), was chosen because
manpower systems are regarded as a set of interconnected
stocks and flows and the common empirical observations are
that flows are proportional to stocks [Ref. 50].

Unfortunately, data for the P matrix come in different
forms, and various computations have to be made before the

information can be utilized. For the officer data, the information was fairly straightforward. The attrition data given in Figures 6 and 7 need only conform to P + W = 1, where the attrition rates equal the wastage rates. The officer retention rates from Figure 5 are already in the W - 1 form, i.e., the wastage rate has been taken into account. But the following formula had to be applied to the enlisted data:

$$P = 1 - W = \frac{G_i + 1}{G_i}$$

where $G_i$ is the probability that an individual will survive from one year to the next. These data for enlisted are shown in Table XXIX of the previous chapter. The reason $G_i$ is divided into $(G_i + 1)$ is that $G_i + 1$ will have a compound wastage rate.

If the data were applied directly to the P matrix, the wastage rate from row 1 would also be contained in row 2 and the wastage rate in row 3 would contain the wastage rates of rows 1 and 2, etc. This would compound the wastage rates and give a false picture of the P matrix, thereby showing a greater loss of personnel than there really would be.

A. OFFICER MANMOD MODEL

The first manpower projection made with the MANMOD model was for the NFO's (1320/5 designators). This projection covered a ten-year span. The ten-year time span was chosen for two reasons. First, the carrier force is planned to

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increase over this time; and second, the average length of time spent by officers in the ranks Ensign (ENS) to LCDR is nine years of service. The breakdowns for the year groups are as follows: ENS (01) first and second years of service, LTJG (02) third and fourth year, LT (03) fifth to end of ninth year, and the tenth year for LCDR (04).

To calculate the stock vector (the N stock vector is the amount of the initial stocks of the individual groups in the study), Table XIII, section B1, and Table XXI (FY 80 data) were used. The data from Table XXI were used because this would give the most current look at NFO production and, hopefully, reflect the upcoming years. Data selected from Table XXI (FY 80) included TJN's, RIO's, ATD's, and only 5 percent of the NAV (Navigator on an aircraft, usually a patrol type aircraft). This figure, 5 percent of the NAV, was chosen because the majority of these individuals serve on Patrol aircraft and are not involved in shipboard squadrons. It was felt that 5 percent would cover the E2C aircraft (the only propellor squadron assigned to a large carrier) NFO needs.

Taking these figures and applying the average attrition rate of 29 percent for student NFO's (from Figure 7), one would end up with a stock of 879 NFO's for the Ensign (01) time span. The average attrition rate for the past twenty years (29 percent) was used in order to provide an overall estimate of NFO students.

Stock vectors for the 02 (LTJG), 03 (LT) and 04 (LCDR) come directly from Table XIII, section B1. It is assumed, then, that all current airwing billets are filled. The 02 and 03 grades are spaced out over two and five year time periods respectively. Since the officer structure is pyramidical, the junior years in each grade were given a larger proportion of the stock. This apportionment of the N (stock vectors) can be seen in the computer run example shown in Table XXX. The same assumptions for apportionment were used for the pilot (1310/5 designators) predictions utilizing Table XIII, section B1, for the 02 to 04 groups, and Table XX for the 01's. (Here, too, personnel stocks are derived by assuming all billets are filled.)

Table XX stocks were calculated by using the percentage of the pilot figures which applied to JET aircraft and 10 percent of the figures which applied to PROP and HELO pilots. (These figures were percentages of the actual production of pilot numbers.) The reason for using only 10 percent of the PROP and HELO was that the same assumptions as were made when calculating the numbers of NFO's needed for propellor aircraft were applied, with the exception that the E2C has two pilots. The 10 percent for HELO's was added to the N (stock vector) to cover the needs of the SH-3 squadrons aboard carriers. Using these figures, and applying the 28 percent average attrition rate (from Figure 6) for student pilots, gives a total stock of 1339 for 01's. Again, the N (stock vectors)

TABLE XXX

EXAMPLE OF OFFICER MANMOD COMPUTER RUN
FOR LCDR ACCESSIONS

<u>NOTES</u>

ENTER N(INITIAL CLASS VALUES)...... .This is the initial stock
:                                     vector showing the number of
    739 600 670 500 200 200 100 100 76 351[a] individuals who are already
ENTER P(TRANSITION MATRIX) BY ROWS.. in the Navy.
ENTER 1TH ROW                        :
:                                    : This is the P matrix where
    0 . 8 0 0 0 0 0 0 0 0[b]            the percentage rates are
ENTER 2TH ROW                          derived from calculations
:                                      which include attrition,
    0 0 .919 0 0 0 0 0 0                retention and promotion in-
ENTER 3TH ROW                          formation. A rate is needed
:                                      for each year studied, with
    0 0 0 1 0 0 0 0 0 0                 the last rate being all
ENTER 4TH ROW                          zeroes because no more cal-
:                                      culations are required past
    0 0 0 0 .98 0 0 0 0 0              this point.
ENTER 5TH ROW
:
    0 0 0 0 0 1 0 0 0 0
ENTER 6TH ROW
:
    0 0 0 0 0 0 1 0 0 0
ENTER 7TH ROW
:
    0 0 0 0 0 0 0 1 0 0
ENTER 8TH ROW
:
    0 0 0 0 0 0 0 0 .65 0
ENTER 9TH ROW
:
    0 0 0 0 0 0 0 0 0 .5274
ENTER 10TH ROW
:
    0 0 0 0 0 0 0 0 0 0
ENTER NUMBER OF RECRUIT TYPE........ This section is where the
    1  FIXED RECRUIT TYPE            programmer chooses the type
    2  ADDITIVE (RECRUIT SIZE)       of recruitment policy to be
    3  MULTIPLICATIVE (RECRUIT SIZE) observed. In this thesis
    4  ADDITIVE (SYSTEM SIZE)        recruitment type one (1) was
    5  MULTIPLICATIVE (SYSTEM SIZE)  chosen because in each run
:                                    accession was assumed to be
    1                                constant over the projected
                                     period.
Notes a, b - see page 83.

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TABLE XXX (continued)

NOTES

ENTER R(RECRUITMENT VECTOR)
: 
   2173 0 0 0 0 0 0 0 0 0 0[c]

ENTER PERCENT CODE..................... At this point the programmer
   0   NO GRADE PERCENTAGES                could select the percentage
   1   GRADE SIZE AS PERCENTAGE OF         rate that will appear in
       TOTAL GRADE SIZE                    the percentage column in
   2   GRADE SIZE AS PERCENTAGE OF         the program runs. This
       ORIGINAL GRADE SIZE                 thesis used selection one
   :                                       (1).
   1
DO YOU WISH TO SEE INTERVENING YEARS.. At this section the program-
   0   NO                                 mer would be able to choose
   1   YES                                whether all years of pro-
   :                                      jection are to be shown or
   1                                      just the last year. If a
END OF INPUT PROGRAM                     zero is chosen, only the
   BASEQN 10[d]                           zero year and the last year
                                          selected will be displayed.

| T | | N | PERCENT | R.......... |
|---|---|---|---|---|
| | | | | : |
| 0 | 1[e] | 739 | ( 21) | : |
| | 2 | 600 | ( 17) | : |
| | 3 | 670 | ( 19) | : |
| | 4 | 500 | ( 14) | : |
| | 5 | 200 | ( 6) | : |
| | 6 | 200 | ( 6) | |
| | 7 | 100 | ( 3) | |
| | 8 | 100 | ( 3) | |
| | 9 | 76 | ( 2) | |
| | 10 | 351 | ( 10) | |
| | TOTAL | 3536 | (100) | 2173 |
| | | | | |
| 1 | 1 | 2173 | ( 43) | |
| | 2 | 591 | ( 12) | |
| | 3 | 551 | ( 11) | |
| | 4 | 670 | ( 13) | |
| | 5 | 490 | ( 10) | |
| | 6 | 200 | ( 4) | |
| | 7 | 200 | ( 4) | |
| | 8 | 100 | ( 2) | |
| | 9 | 65 | ( 1) | |
| | 10 | 40 | ( 1) | |
| | TOTAL | 5081 | (144) | 2173 |

When a one (1) is selected, all years, including the zero year, will be shown.

.......The T column shows the year of the projection and the N column shows the number of individuals found at each row for that year, while the percent column shows the percent of the total N of individuals at each level. The total percentage is based not on the sum of the percentage column but instead on the percent increase or decrease of the zero N stocks. The R column shows the number of recruits for the period shown.

Notes c, d, e – see page 83.

TABLE XXX (continued)

| | | | | |
|---|---|---|---|---|
| 2 | 1 | 2173 | ( 33) | |
| | 2 | 1738 | ( 26) | |
| | 3 | 543 | ( 8) | |
| | 4 | 551 | ( 8) | |
| | 5 | 657 | ( 10) | |
| | 6 | 490 | ( 7) | |
| | 7 | 200 | ( 2) | |
| | 8 | 200 | ( 2) | |
| | 9 | 65 | ( 1) | |
| | 10 | 34 | ( 1) | |
| | TOTAL | 6652 | (188) | 2173 |

. . . . . . . . . . . . . . . . This is the second year point and the second row is now at steady state. The following projected years will have a steady state at each associated row, i.e., at the fourth year point the fourth row will be at steady state. Steady state will occur when the input remains at a constant level over time. Therefore, each year will bring its respective row to a steady state condition until the whole projection is at a steady state and the only way to change this state is to change the recruitment vector (accessions).

| | | | | |
|---|---|---|---|---|
| 3 | 1 | 2173 | ( 27) | |
| | 2 | 1738 | ( 21) | |
| | 3 | 1598 | ( 20) | |
| | 4 | 543 | ( 7) | |
| | 5 | 540 | ( 7) | |
| | 6 | 657 | ( 8) | |
| | 7 | 490 | ( 6) | |
| | 8 | 200 | ( 2) | |
| | 9 | 130 | ( 2) | |
| | 10 | 34 | ( 0) | |
| | TOTAL | 8104 | (229) | 2173 |

. . . . Three rows of steady states have been achieved. This third row for each of the following projected years will be in a steady state, i.e., row 3 for each projected year will have the same number. The other N rows will continue to change until they reach a steady state. The changes are caused by the P matrix percentages.

| | | | | |
|---|---|---|---|---|
| 4 | 1 | 2173 | ( 23) | |
| | 2 | 1738 | ( 18) | |
| | 3 | 1598 | ( 17) | |
| | 4 | 1598 | ( 17) | |
| | 5 | 532 | ( 6) | |
| | 6 | 540 | ( 6) | |
| | 7 | 657 | ( 7) | |
| | 8 | 490 | ( 5) | |
| | 9 | 130 | ( 1) | |
| | 10 | 69 | ( 1) | |
| | TOTAL | 9525 | (269) | 2173 |

| | | | | |
|---|---|---|---|---|
| 5 | 1 | 2173 | ( 20) | |
| | 2 | 1738 | ( 16) | |
| | 3 | 1598 | ( 15) | |
| | 4 | 1598 | ( 15) | |
| | 5 | 1566 | ( 15) | |
| | 6 | 532 | ( 5) | |
| | 7 | 540 | ( 5) | |
| | 8 | 657 | ( 6) | |
| | 9 | 319 | ( 3) | |
| | 10 | 69 | ( 1) | |
| | TOTAL | 10789 | (305) | 2173 |

TABLE XXX (continued)

| 6 | 1 | 2173 | ( 18) | |
|---|---|---|---|---|
| | 2 | 1738 | ( 15) | |
| | 3 | 1598 | ( 13) | |
| | 4 | 1598 | ( 13) | |
| | 5 | 1566 | ( 13) | |
| | 6 | 1566 | ( 13) | |
| | 7 | 532 | ( 4) | |
| | 8 | 540 | ( 5) | |
| | 9 | 427 | ( 4) | |
| | 10 | 168 | ( 1) | |
| | TOTAL | 11905 | (337) | 2173 |

Each of the following year projections will behave in the same manner as the preceding ones until the end projection point is reached. At this end point (10 years in this thesis) all N rows are in steady state. There would be no further changes in the N column if year 20 was requested. The N column represents the amount of individuals who can be found in the period.

| 7 | 1 | 2173 | ( 17) | |
|---|---|---|---|---|
| | 2 | 1738 | ( 13) | |
| | 3 | 1598 | ( 12) | |
| | 4 | 1598 | ( 12) | |
| | 5 | 1566 | ( 12) | |
| | 6 | 1566 | ( 12) | |
| | 7 | 1566 | ( 12) | |
| | 8 | 532 | ( 4) | |
| | 9 | 351 | ( 3) | |
| | 10 | 225 | ( 2) | |
| | TOTAL | 12912 | (365) | 2173 |

| 8 | 1 | 2173 | ( 16) | |
|---|---|---|---|---|
| | 2 | 1738 | ( 13) | |
| | 3 | 1598 | ( 11) | |
| | 4 | 1598 | ( 11) | |
| | 5 | 1566 | ( 11) | |
| | 6 | 1566 | ( 11) | |
| | 7 | 1566 | ( 11) | |
| | 8 | 1566 | ( 11) | |
| | 9 | 346 | ( 2) | |
| | 10 | 185 | ( 1) | |
| | TOTAL | 13900 | (393) | 2173 |

| 9 | 1 | 2173 | ( 15) | |
|---|---|---|---|---|
| | 2 | 1738 | ( 12) | |
| | 3 | 1598 | ( 11) | |
| | 4 | 1598 | ( 11) | |
| | 5 | 1566 | ( 11) | |
| | 6 | 1566 | ( 11) | |
| | 7 | 1566 | ( 11) | |
| | 8 | 1566 | ( 11) | |
| | 9 | 1018 | ( 7) | |
| | 10 | 183 | ( 1) | |
| | TOTAL | 14569 | (412) | 2173 |

TABLE XXX (continued)

```
10     1    2173   ( 15)
       2    1738   ( 12)
       3    1598   ( 11)
       4    1598   ( 11)
       5    1566   ( 10)
       6    1566   ( 10)
       7    1566   ( 10)
       8    1566   ( 10)
       9    1018   (  7)
      10     537   (  4)
    TOTAL 14924   (422)   2173
```

Notes:

a. Each value refers to the initial stock of individuals
   for each year, i.e., 739 ENS in their first year of
   service, 600 ENS in their second year of service, 670
   LTJG's in their first year (third row of table), 500
   LTJG's in their second year, 200 LT's in their first
   year, etc.

b. The .8 shows that only 80 percent of the ENS go into the
   next year point (20 percent lost by attrition). The
   .919 shows that only 91.9 percent of the ENS at this
   year point go on to the next point (LTJG). The other
   rows also show what percentage goes on to their next
   year points. If the percentage is less than 100 per-
   cent, retention, attrition and promotion were taken
   into account.

c. The recruitment vector number is only used at the first
   year point because all recruitment is at the first year
   point, and no lateral entries are included. If lateral
   entries were to be included, then recruitment vector
   numbers would be used at other year points.

d. BASEQN 10 shows that only a 10 year projection was asked
   for; if a 20 year projection had been asked for, BASEQN
   20 would be entered at this point.

e. Each row coincides with the N (initial class vector),
   i.e., row 1 equals ENS at the first year point.....row
   10 is equal to LCDR's.

Appendix D shows a step-by-step utilization of MANMOD as
the program exists in the Naval Postgraduate School's
computer.

Appendix E is the step-by-step APL program used to generate
MANMOD.

were apportioned in a pyramidical fashion over each appropriate segment.

Next, the P (transition matrix) was generated. For the NFO's this matrix contained the wastage rate minus 1 ($P = W - 1$), and the retention rates derived from Figure 7 and Figure 5, respectively. The attrition rate was divided between the first and second year for the 01's. This division was done to cover both years, because the training cycle can take up to two years before an individual is qualified to go on to a squadron. The division of the 29 percent average attrition rate for student NFO's was assessed higher for the first year, at 20 percent, because the greatest loss of students is during the initial training phase [Ref. 51]. The other 9 percent was attached to the second year of the 01 cycle.

For the matrix rows containing the grade of 02 (row three and row four), it was assumed that all individuals who survived ENS (01) second year point would survive to the third year point (first year as a LTJG (02)). Therefore, the value of one (1) was assigned to the third row of the P matrix.

At the fourth year point (fourth row of the matrix), the retention rate was taken to be 98 percent. A 98 percent rather than a 100 percent rate was chosen to cover any losses that might have occurred from promotion failure to LT (03) or change of designator for various reasons. The 2 percent wastage rate could also include death or health problems which could be the cause of an aviator not continuing on to the LCDR (03) level.

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If an individual survived to the fourth year 03 point, it was assumed he would have a 100 percent chance of reaching the seventh year (seventh row of the P matrix). The assumption behind this was that once an individual made it to the 03 level, prior to finishing his aviation obligation, the only losses would be through medical problems or death. These two losses were considered to have insufficient impact (at least in peacetime) on the P matrix to cause any significant changes.

The normal obligation for flight trained individuals is six years for pilots, and four and one-half for the NFO's. This obligation is a payback period required from an individual in return for the flight training he received. The six year total obligation was allotted to both the pilots and NFO's in this thesis, because the normal issue of orders carries a clause that upon acceptance of the orders an obligation is incurred. This obligation would bring the NFO's up to the sixth year of aviation duty along with the pilots.

At the eighth and ninth year point (eighth and ninth row), the P matrix uses the retention data from Figure 5. The retention data were divided equally over the two years because even though the retention data cover all grades, the majority of losses are at the end of the six-year obligation point. This obligation usually places an individual at the eighth or ninth row of the P matrix, depending on acceptance of prior orders. The FY 80 retention data from Figure 5 were utilized.

For the ninth year (ninth row of the P matrix), the
retention data from FY 80 were combined with the average
promotion data from Table XXII. The average promotion data
were selected because of the large differences in the per-
centage rates over the years shown. Also, it was felt that
the promotion rates will not remain as high as those of
FY 79 because the long-term effect of such a high rate would
be a change in the officer pyramid structure. The same
assumptions made for the NFO P matrix were used in making
the pilot P matrix.

Last to be described is the recruitment vector (R).
Since the military has a pyramidical structure, and brings
new individuals in at the bottom, only the first year in the
recruitment vector has recruits. In other words, there is
little or no lateral entry. This assumption of no lateral
entry was made for pilots also.

B. ENLISTED MANMOD MODEL

The enlisted N (stock vector) was calculated from Table
XVII in the same way as the officer N (stock vector), with
the following exceptions. First, Table XVII's stock was
multiplied by thirteen to give a present day stock. (Table
XVII shows only the enlisted personnel needs for one carrier
and since the initial stock of individuals would be for
thirteen carriers, the multiplication was required. This
multiplication had already been done for the officer data
given in Table XIII, section B1.) Second, the apportionment

of stocks over the year groups was more uniform (not as pyramidical as for the officers) because the pyramid effect is less prevalent for enlisted, as is shown by Table XXV. Also, the first period covers E-1 to E-3. Since there are no billets assigned to the E-1's and E-2's, and it takes only one year to make E-3, these paygrades (E-1, E-2 and E-3) were lumped together. It is realized that in those three paygrades individuals have different probabilities of promotion to E-4, but for the model to be tractable, that assumption was made.

The second stock vector contained all E-4's. (E-4's can be promoted to E-5 in nine months, but to keep the groups at yearly intervals a one-year promotion time was assumed.) Third, fourth and fifth rows of the P matrix contained the E-5's. For the sixth, seventh and eighth rows of the P matrix, E-6's were used, and E-7's were used for the ninth row. The E-5 and E-6 paygrades have three-year slots because that is the minimum time that an individual can remain in those paygrades before he can be promoted. It is assumed that all individuals proceed to the next year. There are only nine years in this section, because at the tenth year an individual will still only be at the E-7 paygrade point.

The P matrix for the enlisted was calculated from Table XXIX by applying the formula $P = 1 - W = \dfrac{G_i + 1}{G_i}$ . This calculation takes into account wastage and promotion rates which were applied directly to the P matrix. The R (recruitment vector) is generated in the same fashion as that for officers.

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Table XXXI provides an example of the results obtained from the MANMOD program for the eleven different enlisted ratings.

C. OFFICER AND ENLISTED SUPPLIES UNDER A PRESENT DAY ACCESSION AND RETENTION SCENARIO

The first MANMOD computer runs were done to show how present day accession rates would affect the FY 1990 force requirements if those rates were projected over the next ten years. Table XXXII represents the officer and enlisted supplies as compared to the billets required by the FY 1990's fifteen carrier force. Both FY 80 and FY 81 accession data were used in the computations. No figures appear in column "FY 1990 Projections by FY 1981 Accessions" when the manpower projections are unchanged from the previous column [Ref. 52].

It must also be noted that the figures shown as available for the enlisted ratings/paygrades include all aviation enlistees, and not just those available to the fleet airwings. Therefore, enlisted figures from Table XXXII will be explained more fully later in this chapter.

An examination of the figures shown in Table XXXII for pilots shows clearly that the Navy will have a deficit of seagoing pilot LCDR's (04's) by FY 1990 if the accession, retention, attrition and promotion rates continue at present levels. Particularly interesting is the overage in pilot LT's (03's) which is predicted. With this in mind, it should be remembered that the LT's (03's) are spread over a five-year promotion zone. They are not all eligible for promotion

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TABLE XXXI

EXAMPLE OF ENLISTED MANMOD COMPUTER RUN
FOR AD (E-7) ACCESSIONS

NOTES

ENTER N(INITIAL CLASS VALUES)......... This is the initial stock
 :                                       vector showing the number
     468 754 192 190 190 169 169 169 143[a]   of individuals who are
ENTER P(TRANSITION MATRIX) BY ROWS..     already in the Navy.
ENTER 1TH ROW                         :
 :                                    :
     0 .9478 0 0 0 0 0 0 0[b]          :.. This is the P matrix where
ENTER 2TH ROW                            the percentage rates are
 :                                       derived from calculations
     0 0 .8408 0 0 0 0 0 0               which include attrition,
ENTER 3TH ROW                            retention and promotion
 :                                       information.  A rate is
     0 0 0 .8034 0 0 0 0 0              needed for each year
ENTER 4TH ROW                            studied, with the last
 :                                       rate being all zeroes be-
     0 0 0 0 .4483 0 0 0 0              cause no more calculations
ENTER 5TH ROW                            are required past this
 :                                       point.
     0 0 0 0 0 ,9319 0 0 0
ENTER 6TH ROW
 :
     0 0 0 0 0 0 .9043 0 0
ENTER 7TH ROW
 :
     0 0 0 0 0 0 0 .945 0
ENTER 8TH ROW
 :
     0 0 0 0 0 0 0 0 .9164
ENTER 9TH ROW
 :
     0 0 0 0 0 0 0 0 0
ENTER NUMBER OF RECRUIT TYPE.......... This section is where
     1 FIXED RECRUIT VECTOR              the programmer chooses the
     2 ADDITIVE (RECRUIT SIZE)           type of recruitment policy
     3 MULTIPLICATIVE (RECRUIT SIZE)     to be observed.  In this
     4 ADDITIVE (SYSTEM SIZE)            thesis recruitment type one
     5 MULTIPLICATIVE (RECRUIT SIZE)     (1) was chosen because
 :                                       accession was assumed to be
     1                                   constant over the projected
ENTER R (RECRUITMENT VECTOR)             period.
 :
     1025 0 0 0 0 0 0 0 0[c]

Notes a,b,c - see page 93.

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TABLE XXXI (continued)

NOTES

ENTER PERCENT CODE.....................At this point the programmer
   0 NO GRADE PERCENTAGES           could select the percentage
   1 GRADE SIZE AS PERCENTAGE     rate that will appear in
     OF TOTAL GRADE SIZE         the percentage column in
   2 GRADE SIZE AS PERCENTAGE     the program runs.  This
     OF ORIGINAL GRADE SIZE      thesis used section one (1).
  :
   1

DO YOU WISH TO SEE INTERVENING YEARS. At this section the program-
   0 NO                          mer would be able to choose
   1 YES                       whether all years of projec-
  :                             tion are to be shown or just
   1                             the last year.  If a zero
END OF INPUT PROGRAM          is chosen, only the zero
   BASEQN 10$^d$             year and the last year

| T | | N | PERCENT | R | |
|---|---|---|---|---|---|

selected will be displayed.
When a one is selected, all

| T | | N | PERCENT | R |
|---|---|---|---|---|
| 0 | 1$^e$ | 468 | ( 19) | |
| | 2 | 754 | ( 31) | |
| | 3 | 192 | ( 8) | |
| | 4 | 190 | ( 8) | |
| | 5 | 190 | ( 8) | |
| | 6 | 169 | ( 7) | |
| | 7 | 169 | ( 7) | |
| | 8 | 169 | ( 7) | |
| | 9 | 143 | ( 6) | |
| | TOTAL | 2444 | (100) | 1025 |
| 1 | 1 | 1025 | ( 34) | |
| | 2 | 444 | ( 15) | |
| | 3 | 634 | ( 21) | |
| | 4 | 154 | ( 5) | |
| | 5 | 85 | ( 3) | |
| | 6 | 177 | ( 6) | |
| | 7 | 153 | ( 5) | |
| | 8 | 160 | ( 5) | |
| | 9 | 155 | ( 5) | |
| | TOTAL | 2986 | (122) | 1025 |
| 2 | 1 | 1025 | ( 29) | |
| | 2 | 971 | ( 28) | |
| | 3 | 373 | ( 11) | |
| | 4 | 509 | ( 15) | |
| | 5 | 69 | ( 2) | |
| | 6 | 79 | ( 2) | |
| | 7 | 160 | ( 5) | |
| | 8 | 144 | ( 4) | |
| | 9 | 146 | ( 4) | |
| | TOTAL | 3478 | (14$^2$) | 1025 |

years, including the zero
year, will be shown.

.... The T column shows the year
of the projection and the N
column shows the number of
individuals found at each
row for that year.  While
the percent column shows
the percent from the total
N of individuals at each
level.  The total percentage
is based not on the sum of
the percentage column, but
instead on the percent in-
crease or decrease of the
zero N stocks.  The R column
shows the number of recruits
for the period shown.

.... This is the second year point
and the second row is now at
steady state.  The following
projected years will have a
steady state at each associ-
ated level, i.e., at the
fourth year point the fourth
row will be at steady state.

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TABLE XXXI (continued)

NOTES

| 3 | 1 | 1025 | ( 27) | . . . . . . . . . . . . |
|---|---|------|-------|-------------------------|
|   | 2 | 971  | ( 26) | |
|   | 3 | 817  | ( 22) | |
|   | 4 | 300  | (  8) | |
|   | 5 | 228  | (  6) | |
|   | 6 | 64   | (  2) | |
|   | 7 | 72   | (  2) | |
|   | 8 | 151  | (  4) | |
|   | 9 | 132  | (  4) | |
|   | TOTAL | 3761 | (154) | 1025 |

| 4 | 1 | 1025 | ( 25) |
|---|---|------|-------|
|   | 2 | 971  | ( 24) |
|   | 3 | 817  | ( 20) |
|   | 4 | 656  | ( 16) |
|   | 5 | 134  | (  3) |
|   | 6 | 213  | (  5) |
|   | 7 | 58   | (  1) |
|   | 8 | 68   | (  2) |
|   | 9 | 139  | (  3) |
|   | TOTAL | 4081 | (167) | 1025 |

| 5 | 1 | 1025 | ( 24) |
|---|---|------|-------|
|   | 2 | 971  | ( 23) |
|   | 3 | 817  | ( 19) |
|   | 4 | 656  | ( 16) |
|   | 5 | 294  | (  7) |
|   | 6 | 125  | (  3) |
|   | 7 | 192  | (  5) |
|   | 8 | 55   | (  1) |
|   | 9 | 62   | (  1) |
|   | TOTAL | 4199 | (172) | 1025 |

| 6 | 1 | 1025 | ( 23) |
|---|---|------|-------|
|   | 2 | 971  | ( 22) |
|   | 3 | 817  | ( 19) |
|   | 4 | 656  | ( 15) |
|   | 5 | 294  | (  7) |
|   | 6 | 274  | (  6) |
|   | 7 | 113  | (  3) |
|   | 8 | 182  | (  4) |
|   | 9 | 50   | (  1) |
|   | TOTAL | 4383 | (179) | 1025 |

Steady state will occur when the input remains at a constant level over time. Therefore, each year will bring its respective level to a steady state condition until the whole projection is at a steady state and the only way to change this state is to change the recruitment vector (accessions).

Three rows of steady state have been achieved. This third row for each of the following projected years will be in a steady state, i.e., row 3 for each projection year will have the same number. The other N rows will continue to change until they reach a steady state. The changes are caused by the P matrix percentages.

TABLE XXXI (continued)

NOTES

| 7 | 1 | 1025 | ( 22) | |
| | 2 | 971 | ( 21) | |
| | 3 | 817 | ( 18) | |
| | 4 | 656 | ( 14) | |
| | 5 | 294 | ( 6) | |
| | 6 | 274 | ( 6) | |
| | 7 | 248 | ( 5) | |
| | 8 | 107 | ( 2) | |
| | 9 | 167 | ( 4) | |
| | TOTAL | 4559 | (187) | 1025 |

| 8 | 1 | 1025 | ( 22) | |
| | 2 | 971 | ( 21) | |
| | 3 | 817 | ( 18) | |
| | 4 | 656 | ( 14) | |
| | 5 | 294 | ( 6) | |
| | 6 | 274 | ( 6) | |
| | 7 | 248 | ( 5) | |
| | 8 | 234 | ( 5) | |
| | 9 | 98 | ( 2) | |
| | TOTAL | 4618 | (189) | 1025 |

| 9 | 1 | 1025 | ( 22) | |
| | 2 | 971 | ( 21) | |
| | 3 | 817 | ( 17) | |
| | 4 | 656 | ( 14) | |
| | 5 | 294 | ( 6) | |
| | 6 | 274 | ( 6) | |
| | 7 | 248 | ( 5) | |
| | 8 | 234 | ( 5) | |
| | 9 | 215 | ( 5) | |
| | TOTAL | 4735 | (194) | 1025 |

| 10 | 1 | 1025 | ( 22) | |
| | 2 | 971 | ( 21) | |
| | 3 | 817 | ( 17) | |
| | 4 | 656 | ( 14) | |
| | 5 | 294 | ( 6) | |
| | 6 | 274 | ( 6) | |
| | 7 | 248 | ( 5) | |
| | 8 | 234 | ( 5) | |
| | 9 | 215 | ( 5) | |
| | TOTAL | 4735 | (194) | 1025 |

Each of the following year projections will behave in the same manner as the preceding ones until the end projection point is reached. At this point (9 years in this thesis) all N rows are in steady state. There would be no further changes in the N column if year 20 was requested. The N column represents the amount of individuals who can be found in the period.

TABLE XXXI (continued)

Notes:

a.  Each value refers to the initial stocks of individuals
    for each year segment, i.e., 468 E-1's to E-3's in the
    first year, 754 E-4's in the second year of service,
    192 E-5's in their first year, 190 E-5's in their
    second year, 190 E-5's in their third year, etc.

b.  The .9478 shows that only 94.78 percent of the E-1's
    to E-3's go onto the next year point (5.22 percent loss
    by attrition). The .8408 shows that only 84.08 percent
    of the E-4's at this year point go onto E-5's. The
    other rows also show what percentage go onto the next
    year. If the percentages are less than 100 percent
    retention, attrition and promotion were taken into
    account.

c.  The recruitment vector number is only used at the first
    year point because all recruitment was at the first
    year point and no lateral entries were included. If
    lateral entries were to be included, their recruitment
    vector numbers would be used at other year points.

d.  BASEQN 10 shows that only ten year projections were
    asked for. If a twenty year projection were asked for,
    BASEQN 20 would be entered at this point.

e.  Each row coincides with the N (initial class value),
    i.e., row 1 equals E-1's to E-3's at the first year
    point,....., row 10 is equal to E-7's.

Appendix D shows a step-by-step utilization of MANMOD as
the program exists in the Naval Postgraduate School's
computer.

Appendix E is the step-by-step APL program used to generate
MANMOD.

TABLE XXXII

OFFICER AND ENLISTED MANMOD PROJECTIONS
UNDER A CURRENT ACCESSION SCENARIO

| Designator or Ratings | Actual[a] FY 1980 Accessions | Actual[b] FY 1981 Accessions | FY 1990[c] Aviation Billet Requirements | FY 1990[d] Projections from FY 80 Accessions | FY 1990[e] Projections from FY 81 Accessions |
|---|---|---|---|---|---|
| PILOT-LCDR[f] | 1339 | 1339 | 537 | 331 | |
| -LT | | | 1014 | 4487 | |
| -LTJG | | | 1755 | 1968 | |
| NFO -LCDR | 879 | 879 | 275 | 362 | |
| -LT | | | 585 | 3010 | |
| -LTJG | | | 1443 | 1266 | |
| AD -E-7 | 1460 | 1260 | 215 | 306 | 264 |
| -E-6 | | | 761 | 1078 | 930 |
| -E-5 | | | 858 | 2517 | 2173 |
| -E-4 | | | 1131 | 1384 | 1194 |
| AE -E-7 | 1432 | 1432 | 156 | 337 | |
| -E-6 | | | 1141 | 1299 | |
| -E-5 | | | 1053 | 2896 | |
| -E-4 | | | 1073 | 1432 | |
| AME -E-7 | 365 | 365 | 0 | 93 | |
| -E-6 | | | 322 | 352 | |
| -E-5 | | | 410 | 770 | |
| -E-4 | | | 449 | 365 | |
| AMH -E-7 | 519 | 519 | 117 | 127 | |
| -E-6 | | | 410 | 458 | |
| -E-5 | | | 566 | 946 | |
| -E-4 | | | 624 | 482 | |
| AMS -E-7 | 981 | 881 | 195 | 228 | 205 |
| -E-6 | | | 624 | 806 | 723 |
| -E-5 | | | 800 | 1767 | 1586 |
| -E-4 | | | 1095 | 916 | 823 |
| AO -E-7 | 713 | 713 | 156 | 156 | |
| -E-6 | | | 624 | 569 | |
| -E-5 | | | 663 | 1261 | |
| -E-4 | | | 741 | 695 | |
| AT -E-7 | 1502 | 1202 | 254 | 461 | 369 |
| -E-6 | | | 429 | 1920 | 1537 |
| -E-5 | | | 1833 | 3366 | 2694 |
| -E-4 | | | 1736 | 1502 | 1202 |

Notes a,b,c,d,e - see page 95.

TABLE XXXII (continued)

| Designator or Ratings | Actual[a] FY 1980 Accessions | Actual[b] FY 1981 Accessions | FY 1990[c] Aviation Billet Requirements | FY 1990[d] Projections from FY 80 Accessions | FY 1990[e] Projections from FY 81 Accessions |
|---|---|---|---|---|---|
| AQ -E-7 | 729 | 729 | 98 | 263 | |
| -E-6 | | | 215 | 1264 | |
| -E-5 | | | 800 | 2369 | |
| -E-4 | | | 644 | 1029 | |
| AW -E-7 | 618 | 548 | 59 | 150 | 133 |
| -E-6 | | | 78 | 608 | 540 |
| -E-5 | | | 234 | 1280 | 1135 |
| -E-4 | | | 215 | 618 | 548 |
| AX -E-7 | 325 | 295 | 20 | 127 | 115 |
| -E-6 | | | 78 | 447 | 405 |
| -E-5 | | | 98 | 728 | 661 |
| -E-4 | | | 176 | 325 | 295 |
| PR -E-7 | 251 | 211 | 0 | 79 | 67 |
| -E-6 | | | 78 | 277 | 233 |
| -E-5 | | | 254 | 530 | 445 |
| -E-4 | | | 234 | 229 | 211 |

Notes:

a. This column (Actual FY 1980 Accessions) shows the actual accessions at entry level into the various designators and ratings for FY 1980.

b. This column (Actual FY 1981 Accessions) shows the actual accessions at entry level into the various designators and ratings for FY 1981.

c. This column (FY 1990 Aviation Billet Requirements) shows projected billet requirements for the FY 1990 fifteen carrier aviation force by designator/rank and rating/ paygrade.

d. This column (FY 1990 Projections by FY 1980 Accessions) shows the resulting number of individuals available in each designator/rank and rating/paygrade in FY 1990 if FY 1980 accession data were projected for ten years (keeping accessions, attritions, retentions and promotion rates constant at the FY 1980 levels).

e. This column (FY 1990 Projections by FY 1981 Accessions) shows the resulting number of individuals available in each designator/rank and rating/paygrade in FY 1990 if

TABLE XXXII (continued)

 FY 1981 accession data were projected to FY 1990 (keeping attrition, retention and promotion rates constant at the FY 1980 levels and accessions data at the FY 1981 level).

f. By comparing the figures shown in the FY 1990 Aviation Billet Requirements column with those in the last two columns, one can find the overages and deficits of manning as calculated by MANMOD.


to the LCDR level. Further, it must be noted that due to the high attrition rate in this rank (LT), a sufficiently high number of these officers will leave the service prior to becoming eligible for promotion to keep LCDR shortages constant.

Closer examination of high attrition rates for LT's (03) shows the worst rates in the eighth and ninth years of service, making it obvious that the bulk of the pilot LT's shown to be available in Table XXXII (4487 in number) are in the first three years of that rank zone. This creates a middle management problem, not only later at the LCDR level, but also in billets which require the experience of a senior LT, i.e., catapult/arresting gear officer. Manpower problems exist, therefore, not only in terms of lack of personnel in total numbers, but also in the distribution of the available personnel throughout their years of service. The results show that there will be no manning problem in the rank of LTJG if current accession, retention, promotion and attrition data remain constant.

The figures in Table XXXII indicate that NFO manning in the fifteen carrier force airwings will not present a problem, except at the LTJG level, where a deficit of 217 individuals is found. However, these figures, like those for pilots, presuppose that accession flows remain constant at the FY 80 and FY 81 levels and that retention and attrition figures do not worsen at the eighth and ninth year point of service.

The enlisted figures in Table XXXII show, in almost all cases, a larger quantity of individuals available, if current accessions remain constant, than the fifteen carrier force airwing manpower billet projections require. These availability figures, however, are subject to a fifty percent reduction since they include all Navy aviation enlistees in the eleven chosen rates, and not just those available to be assigned to the carrier airwings. The enlisted ratings studied in this thesis are also used in Patrol Squadrons (P-3 aircraft), sea-going helicopter squadrons (LAMPS), and shore-based activities (Fleet Composite Squadrons).

D.  ENLISTED MANPOWER PROJECTIONS RESULTS

Tables XXXIII and XXXIV show only fifty percent of the total number of accessions (FY 80 and FY 81 accession data respectively) by ratings/paygrade projected to FY 90. The fifty percent reduction in figures is based upon the fact that fifty percent of all officers (pilots/NFO's) trained are assigned to carrier airwing squadrons. This fact was derived from calculations based on Tables XX and XXI which show the

## TABLE XXXIII

### CARRIER ENLISTED AVIATION SHORTAGES/OVERAGES BY ONE-HALF OF FY 1980 ACCESSIONS

| Rating/ Paygrade | One-Half[a] of Actual FY 1980 Accessions | FY 1990[b] Aviation Billet Requirements | FY 1990[c] Manpower Supply Projections Using One-Half of FY 1980 Accessions | (Shortages)/[d] Overages: Supply Compared to FY 90 Billet Requirements |
|---|---|---|---|---|
| AD  -E-7 | 730 | 215 | 153 | ( 62) |
| -E-6 | | 761 | 539 | (222) |
| -E-5 | | 858 | 1259 | 401 |
| -E-4 | | 1131 | 692 | (439) |
| AE  -E-7 | 716 | 156 | 168 | 12 |
| -E-6 | | 1141 | 650 | (491) |
| -E-5 | | 1053 | 1448 | 395 |
| -E-4 | | 1073 | 716 | (357) |
| AME -E-7 | 183 | --[e] | -- | -- |
| -E-6 | | 322 | 176 | (146) |
| -E-5 | | 410 | 385 | ( 35) |
| -E-4 | | 449 | 183 | (266) |
| AMH -E-7 | 260 | 117 | 64 | ( 53) |
| -E-6 | | 410 | 229 | (181) |
| -E-5 | | 566 | 473 | ( 93) |
| -E-4 | | 624 | 241 | (383) |
| AMS -E-7 | 491 | 195 | 114 | ( 81) |
| -E-6 | | 624 | 403 | (221) |
| -E-5 | | 800 | 884 | 84 |
| -E-4 | | 1095 | 458 | (637) |
| AO  -E-7 | 357 | 156 | 78 | ( 78) |
| -E-6 | | 624 | 285 | (339) |
| -E-5 | | 663 | 631 | ( 32) |
| -E-4 | | 741 | 348 | (392) |
| AT  -E-7 | 756 | 254 | 231 | ( 23) |
| -E-6 | | 429 | 960 | 531 |
| -E-5 | | 1833 | 1683 | (150) |
| -E-4 | | 1736 | 751 | (985) |
| AQ  -E-7 | 365 | 98 | 132 | 34 |
| -E-6 | | 215 | 632 | 417 |
| -E-5 | | 800 | 1185 | 385 |
| -E-4 | | 644 | 515 | (129) |

Notes a,b,c,d,e - see following page.

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TABLE XXXIII (continued)

| Rating/ Paygrade | One-Half Actual [a] FY 1980 Accessions | FY 1990 [b] Aviation Billet Requirements | FY 1990 [c] Manpower Supply Projections | (Shortages)/ [d] Overages: Supply |
|---|---|---|---|---|
| AW  -E-7 | 309 | 59 | 75 | 16 |
| -E-6 | | 78 | 304 | 226 |
| -E-5 | | 234 | 640 | 406 |
| -E-4 | | 215 | 309 | 94 |
| AX  -E-7 | 163 | 20 | 64 | 44 |
| -E-6 | | 78 | 224 | 146 |
| -E-5 | | 98 | 364 | 266 |
| -E-4 | | 176 | 163 | ( 13) |
| PR  -E-7 | 126 | --- [e] | --- | --- |
| -E-6 | | 78 | 139 | 61 |
| -E-5 | | 254 | 265 | 11 |
| -E-4 | | 234 | 115 | (119) |

Notes:

a.  This column (One-Half of Actual FY 1980 Accessions)
    shows a 50 percent reduction in the FY 1980 accession
    data used in Table XXXII because it was assumed that
    50 percent of the total accessions would not go to a
    carrier airwing.  (This percentage is based on the
    fact that 50 percent of the aviation officer accessions
    go to other than carrier airwings.)

b.  This column (FY 1990 Aviation Billet Requirements) show
    projected billet requirements for the FY 1990 fifteen
    carrier aviation force by rating/paygrade.

c.  This column (FY 1990 Manpower Projections by One-Half
    of FY 1980 Accessions) is half of Table XXXII's enlisted
    FY 1990 Projections by FY 1980 Accessions section.
    (Only half the accessed personnel were used because
    this would be the amount of individuals if only half of
    of the accessions were used).

d.  This column ((Shortages)/Overages from Accessions
    Compared to FY 90 Billet Requirements) is the resultant
    from subtracting the two previous columns from each
    other.  The numbers in parentheses are shortages.

e.  No figures appear at these ratings/paygrades because
    there are no aviation billet requirements at these
    levels.

Source:  Compiled from Table XXXII.

TABLE XXXIV

CARRIER ENLISTED AVIATION SHORTAGES/OVERAGES
USING ONE-HALF OF FY 1981 ACCESSIONS

| Rating/ Paygrade | One-Half[a] of Actual FY 1981 Accessions | FY 1990[b] Aviation Billet Requirements | FY 1990[c] Manpower Supply Projections Using One-Half of FY 1981 Accessions | (Shortages)/[d] Overages: Supply Compared to FY 90 Billet Requirements |
|---|---|---|---|---|
| AD -E-7 | 630 | 215 | 132 | ( 83) |
| -E-6 | | 761 | 465 | (306) |
| -E-5 | | 858 | 1087 | 229 |
| -E-4 | | 1131 | 597 | (534) |
| AE -E-7 | 716 | 156 | 168 | 12 |
| -E-6 | | 1141 | 650 | (491) |
| -E-5 | | 1053 | 1448 | 395 |
| -E-4 | | 1073 | 716 | (357) |
| AME -E-7 | 183 | --[e] | — | — |
| -E-6 | | 322 | 176 | (146) |
| -E-5 | | 410 | 385 | ( 35) |
| -E-4 | | 449 | 183 | (266) |
| AMH -E-7 | 260 | 117 | 64 | ( 53) |
| -E-6 | | 410 | 229 | (181) |
| -E-5 | | 566 | 473 | ( 93) |
| -E-4 | | 624 | 241 | (383) |
| AMS -E-7 | 441 | 195 | 103 | ( 92) |
| -E-6 | | 624 | 362 | (262) |
| -E-5 | | 800 | 793 | ( 7) |
| -E-4 | | 1095 | 412 | (683) |
| AO -E-7 | 357 | 156 | 78 | ( 78) |
| -E-6 | | 624 | 285 | (339) |
| -E-5 | | 663 | 631 | ( 32) |
| -E-4 | | 741 | 348 | (392) |
| AT -E-7 | 601 | 254 | 185 | ( 79) |
| -E-6 | | 429 | 769 | 340 |
| -E-5 | | 1833 | 1683 | (486) |
| -E-4 | | 1736 | 751 | (1135) |
| AQ -E-7 | 365 | 98 | 132 | 34 |
| -E-6 | | 215 | 632 | 417 |
| -E-5 | | 800 | 1185 | 385 |
| -E-4 | | 644 | 515 | (129) |

Notes a,b,c,d,e - see following page.

TABLE XXXIV (continued)

| Rating/ Paygrade | | One-Half[a] of Actual FY 1981 Accessions | FY 1990[b] Aviation Billet Requirements | FY 1990[c] Manpower Supply Projections Using One-Half of FY 1981 Accessions | (Shortages)[d] Overages: Supply Compared to FY 90 Billet Requirements |
|---|---|---|---|---|---|
| AW | -E-7 | 274 | 59 | 67 | 8 |
| | -E-6 | | 78 | 270 | 202 |
| | -E-5 | | 234 | 568 | 334 |
| | -E-4 | | 215 | 274 | 59 |
| AX | -E-7 | 148 | 20 | 58 | 38 |
| | -E-6 | | 78 | 203 | 125 |
| | -E-5 | | 98 | 332 | 234 |
| | -E-4 | | 176 | 148 | ( 28) |
| PR | -E-7 | 106 | --[e] | -- | -- |
| | -E-6 | | 78 | 117 | 39 |
| | -E-5 | | 254 | 223 | ( 31) |
| | -E-4 | | 234 | 106 | (128) |

Notes:

a. This column (One-Half of Actual FY 1981 Accessions) shows a 50 percent reduction in the FY 1981 accession data used in Table XXXII because it was assumed that 50 percent of the total accessions would not go to a carrier airwing. (This percentage is based on the fact that 50 percent of the aviation officers accessions go to other than carrier airwings.)

b. This column (FY 1990 Aviation Billet Requirements) shows projected billet requirements for the FY 1990 fifteen carrier aviation force by rating/paygrade.

c. This column (FY 1990 Manpower Projections by One-Half of FY 1981 Accessions) is half of Table XXXII's enlisted FY 1990 Projections by FY 1981 Accession section. (Only half the accessed personnel were used because this would be the amount of individuals if only half of the accessions were used.)

d. This column ((Shortages)/Overages from Accession Compared to FY 90 Billet Requirements) is the result from subtracting the two previous columns from each other. The numbers in parens are shortages.

e. No figure appears at these ratings/paygrades because there are no aviation billet requirements at these levels.

Source:  Compiled from Table XXXII.

number of aviation students and to which type of aviation field they are trained. The assumption is therefore made that approximately 50 percent of the aviation enlisted accessions would be required as a support factor for the seagoing airwing squadrons to which these officers are assigned. It is understood that these figures are approximate, but it was not possible to refine the available data to show exact billeting of individuals in each of the ratings discussed.

Deficits in the manning of the FY 90 carrier enlisted airwing force, according to Tables XXXII and XXXIV, would appear in the following ratings: AD, AE, AME, AMH, AMS, AO, AT, with slight shortages also in AQ, AX and PR ratings at the E-4 paygrade level only. Severe shortages are evident in seven of the eleven ratings studied using both FY 80 or FY 81 accession data. These shortages occur at almost all levels, but particularly at the mid-management E-6 level. In all of these ratings except for the AT rating shortages increase dramatically from the E-5 to E-6 level. Replacement of these trained and experienced individuals cannot be satisfactorily achieved by increasing accessions. Increased retention during the three-year promotion span from E-5 to E-6 (minimum time in grade) seems a much more satisfactory solution. Whether by increasing the percentage promoted, shortening the promotion zone (time spent in paygrade) or by offering more substantial financial incentives (reenlistment bonuses/pay increases) it seems imperative to the

feasibility of manning the enlisted billets of the FY 1990
carrier airwing force that more of the personnel in these
ratings (AD, AE, AME, AMH, AMS and AO) be induced to remain
past the E-5 and E-6 paygrade. This fact is driven home by
the knowledge that the Navy, at the beginning of this study,
was 20,000 to 22,000 middle grade petty officers undermanned.

E.  ADDITIONAL AVIATION OFFICER AND ENLISTED SUPPLY-
    DEMAND ANALYSES USING ACCESSIONS TO FILL BILLETS

    Tables XXX and XXXI provide samples of results of addi-
tional MANMOD computer runs. Each paygrade grouping required
one computer run, i.e., for the officers there were three
computer runs each, and for the enlisted ratings, four com-
puter runs each. For each computer run, an R (recruitment
vector) was found by the trial and error method. The number
used for the R (recruitment vector), for each computer run,
had to generate the required number or just exceed the man-
power billet projected requirements listed in Table XIV for
the officers and Table XIX for the enlisted. This was accom-
plished by increasing accessions at the entry level (E-1 to
E-3) for enlisted and at the ENS (01) level for officers.
These numbers were then projected over the decade using attri-
tion, retention and promotion as variables. (On some computer
runs, the manpower billet requirements could not be exactly
fulfilled, so the R (recruitment vector) that would just
exceed the requirements was selected.)

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Table XXXV shows the actual number of annual entry level accessions necessary to fill exactly the FY 1990 fifteen carrier airwing billets by designator/rank and by rating/paygrade.

In looking at the officer section of Table XXXV, one sees that the pilot accessions requirements are larger than those for the NFO's, with the required accessions for pilots being almost twice those required for NFO's, except at the LTJG level [Ref. 53]. The number of pilots needed is greater because of the difference in retention rates between pilots and NFO's.

In order to fill the FY 1990 fifteen carrier airwing force requirements at the LCDR pilot level by use of a change in accessions only, the Navy would have to start today annually training almost twice as many new aviation student pilots as being trained at present [Ref. 54]. The average student pilot load for 1980 was 1,249 individuals and the average NFO load was 552 [Ref. 55]. When these loads are compared with the actual FY 1980 production of pilots and NFO's (Tables XX and XXI), one can see that the production of pilots is far behind the projected requirements. In fact, for the Navy to meet its FY 90 LCDR pilot requirements utilizing increased accessions as the solution to its manning problem, the Navy would have to start a massive pilot recruitment program (2173 annually), as well as increase the throughput of all phases of flight training.

## TABLE XXXV

### OFFICER AND ENLISTED MANMOD PROJECTED MANPOWER
### ACCESSIONS FOR REQUIRED BILLETS

| Designator or Ratings | FY 1990[a] Aviation Billets Required for 15 Carriers | Annual Entry Level[b] Accessions Required to Fill Billets Needed |
|---|---|---|
| PILOT-LCDR[c] | 537 | 2173 |
| -LT | 1014 | 303 |
| -LTJG | 1755 | 1193 |
| NFO -LCDR | 275 | 662 |
| -LT | 585 | 171 |
| -LTJG | 1443 | 1003 |
| AD -E-7 | 215 | 1025 |
| -E-6 | 761 | 1031 |
| -E-5 | 858 | 498 |
| -E-4 | 1131 | 1193 |
| AE -E-7 | 156 | 662 |
| -E-6 | 1141 | 1259 |
| -E-5 | 1053 | 521 |
| -E-4 | 1073 | 1073 |
| AME -E-7 | --[d] | --[d] |
| -E-6 | 322 | 343 |
| -E-5 | 410 | 195 |
| -E-4 | 449 | 449 |
| AMH -E-7 | 117 | 475 |
| -E-6 | 410 | 465 |
| -E-5 | 566 | 311 |
| -E-4 | 624 | 672 |
| AMS -E-7 | 195 | 838 |
| -E-6 | 624 | 761 |
| -E-5 | 800 | 445 |
| -E-4 | 1095 | 1172 |
| AO -E-7 | 156 | 709 |
| -E-6 | 624 | 781 |
| -E-5 | 663 | 375 |
| -E-4 | 741 | 760 |
| AT -E-7 | 254 | 827 |
| -E-6 | 429 | 336 |
| -E-5 | 1833 | 819 |
| -E-4 | 1736 | 1736 |

Notes a,b,c,d - see next page.

TABLE XXXV (continued)

| Designator or Ratings | | FY 1990[a] Aviation Billets Required for 15 Carriers | Annual Entry Level[b] Accessions Required to Fill Billets Needed |
|---|---|---|---|
| AQ | -E-7 | 98 | 382 |
|    | -E-6 | 215 | 175 |
|    | -E-5 | 800 | 348 |
|    | -E-4 | 644 | 644 |
| AW | -E-7 | 59 | 241 |
|    | -E-6 | 78 | 80 |
|    | -E-5 | 234 | 113 |
|    | -E-4 | 215 | 215 |
| AX | -E-7 | 20 | 51 |
|    | -E-6 | 78 | 57 |
|    | -E-5 | 98 | 44 |
|    | -E-4 | 176 | 176 |
| PR | -E-7 | --[d] | --[d] |
|    | -E-6 | 78 | 70 |
|    | -E-5 | 254 | 120 |
|    | -E-4 | 234 | 234 |

Notes:

a. This column (FY 1990 Aviation Billets Required for 15 Carriers) shows projected billet requirements for the FY 1990 fifteen carrier aviation force by designator/rank and rating/paygrade.

b. This column (Annual Accessions Required to Fill Billets Needed) shows the numbers of individuals who would have to be accessed (at entry level) into each designator and rating annually between the present time and FY 1990 in order to provide the necessary numbers of personnel at the ranks and paygrades shown in the Designator or Ranks column for FY 1990. (Each accession figure shown in the accession column was calculated solely for the designator/ rank and rate/paygrade opposite using the attrition, retention and promotion data from FY 1980.)

c. The number 2173 which appears at the top of the accessions column indicates the entry accessions, required yearly, to provide 573 (billet requirements column) pilot LCDR's by FY 1990. If only the LT pilots rank were considered, then only 303 individuals would have to be accessed annually to meet the FY 1990 requirements (1014 billets required). (It is obvious, therefore, that changes in accessions policies alone cannot solve the FY 1990 manning problems, since no single accession figure provides ade- quate manning at all levels due to variance in retention, attrition and promotion.)

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TABLE XXXV (continued)

Notes:

    d.  No figures appear at these ratings/paygrades because there are no aviation billet requirements at these levels.

At this point, it becomes necessary to point out that increased accessions, or indeed maintenance of FY 80 and FY 81 levels of accessions, may not be easily achieved over the next decade. Demographic studies show a decreasing manpower pool in the 17 to 24 year age group from which the Navy draws the greatest part of its present accessions [Ref. 56]. Bearing this in mind and remembering that the Navy is presently 20,000 to 22,000 midle grade petty officers undermanned, it is evident that Naval aviation will have great difficulty in combating the shortages seen occurring in pilot ranks and in the enlisted ratings (AD, AE, AME, AMH, AMS and AO) by FY 1990. If accessions are not maintained, or in some cases increased, as shown in Tables XXXIII and XXXIV, it becomes apparent that the feasibility of adequately manning the FY 1990 fifteen carrier airwing force is in serious question.

F.  ALTERNATIVE RETENTION, ACCESSION AND PROMOTION POLICIES

    Presently, the LT and LCDR (pilot) retention rates are at only 30 percent. In order to achieve the FY 1990 airwing pilot LCDR's required levels by use of accessions alone, the Navy would have to access 2,173 entry level student pilots

per annum.  The column labeled "Retention Rates Change, All
Other Rates Remain Constant" in Table XXXVI shows that by
increasing the present retention rate (30 percent) to 66 per-
cent, the need for such massive numbers of new accessions
would be alleviated.  A retention rate of 66 percent is quite
high, of course.

The projected supply of NFO LCDR's at FY 1990 is in excess
of the projected required billets.  Should the Navy desire to
eliminate the overage, a change in promotion policy would be
required, lowering the present promotion rate from LT to LCDR
to 52 percent.  (The present rate is 70 percent.)  Such a
change in policy with respect to NFO's would, however, have
effects on both accessions and retention at earlier career
stages.  It is, therefore, not recommended that such sharp
cuts in retention (by promotion policy changes) be adopted.

"The Retention and Promotion Rates Change, All Other Rates
Remain Constant" column of Table XXXVI shows the interaction
between promotion and retention rates for LT to LCDR ranks,
both pilots and NFO's.  It was found that if the pilot promo-
tion rate (from LT to LCDR) was raised from 81 percent (present
day level) to 87 percent, and accession and attrition rates
remained constant, the retention level required to meet FY
1990 carrier airwing projected billets would be 60 percent
rather than the 66 percent shown in the previous column, where
no change in promotion, accession or attrition was made.

TABLE XXXVI

SUMMARY OF AVIATION OFFICER DESIGNATOR
ACCESSION, RETENTION AND PROMOTION ALTERNATIVES

| Designator[a] and Rank | Actual[b] FY 80/1 Accession Requirements | FY 1990[c] Aviation Billet Requirements | FY 1990[d] Supply Projections Using FY 1980 Accessions | Annual[e] Accessions Required to Fill Billets Needed | Retention[f] Rates Change All Other Rates Remain Constant | Retention[g] & Promotion Rates Change All Other Rates Remain Constant | Changes[h] in Retention, Promotion by Reducing Accessions |
|---|---|---|---|---|---|---|---|
| PILOT-LCDR | 1339 | 537 | 331 | 2173 | f | -- | -- |
| -LT | | 1014 | 4487 | 303 | 66% | 60%/87% | 75%/92% or 86%/81% |
| NFO -LCDR | 879 | 275 | 362 | 662 | f | -- | -- |
| -LT | | 585 | 3010 | 171 | 52% | 70%/58% | 70%/73% |

Notes:

a.  Data from Table XXXII.

b.  Data from Table XXXII.

c.  Assumes FY 80 accession numbers used FY 81 - FY 90, and retention, promotion and attrition rates stay at FY 80 levels.

d.  Data from Table XXXV.

e.  This column shows that a 66% pilot retention rate and a NFO retention rate of 52% will attain the FY 1990 billet requirements (accession, attrition and promotion remaining at present day rates).

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TABLE XXXVI (continued)

Notes:

f.  This column shows that to meet the FY 1990 billet requirements, a promotion rate increase (from 81 to 87 percent) will reduce the needed retention rate from 66 to 60 percent for pilots and a promotion rate of 58 percent for the NFO's will allow a 70 percent retention rate.

g.  This column shows that if yearly accessions are allowed to decrease (150) for pilots, the retention rate would have to increase to 75 percent with an increase in the promotion rate to 92 percent, or an 86 percent retention rate coupled with an 81 percent promotion rate would be required to fulfill the FY 1990 billet requirements. A reduction for the NFO's by 125 annually would allow the present day retention rate of 70 percent coupled with a 7 percent decrease in promotions (from 80 to 73 percent) to meet the FY 1990 requirements.

h.  Only data for the 8th and 9th year LT rank were generated because this level is in the area of maximum concern.

Source:  Tables XXXII and XXXV coupled with officer attrition, accession, retention and promotion data.

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Lowering the numbers of NFO LCDR's from the present pro-
jected over supply to the levels required by the FY 1990
fifteen carrier airwings by use of promotion policy would
involve cutting promotions from the present day 80 percent
level to 58 percent. This figure (58 percent) and the analy-
sis assumes the present 70 percent retention rate would stay
intact. It is most unlikely that either accessions or
retentions could be kept at today's levels if the possibility
of promotions for NFO's to the rank of LCDR were reduced to
only 58 percent.

Increasing accessions was not considered as a viable
solution to the Navy's pilot problem because of demographic
trends over the next decade. The possibility of accessions
actually decreasing is worth consideration. Should this
reduction be only 150 individuals per annum (a reduction from
1339 to 1189 pilots per year), an increase in pilot retention
rates from the present 30 percent to 75 percent would be
necessary, along with an increased promotion rate of 92 per-
cent (it is presently at 81 percent). Obviously this acces-
sion decrease, or indeed any accession decrease, could worsen
severely the Navy's already serious pilot problem. If acces-
sions could be held constant, policies aimed at increased
retention, coupled with some increase in promotion rates,
seem to be the most viable approach to ensuring a force suf-
ficient to fill the pilot billets which the FY 1990 fifteen
carrier airwings will require.

Accession decreases, on the other hand, seem to be the best way in which to reduce the NFO's at the LT to LCDR level. Large reductions in promotions for mid-career officers could have unpredictable results. A backlash might lead to fewer accessions, or increased carrier attrition rates might develop--either could cause an eventual deficit in numbers of NFO's. An accession decrease of only 125 (a reduction from 879 to 754 per year) at present day retention rates would require only a 7 percent reduction in promotions (from 80 percent to 73 percent) in order to meet FY 1990 requirements. This accession decrease is recommended as the best approach to containing the numbers of NFO LCDR's within required projected levels.

The enlisted rates, like the pilots, have been shown to suffer their greatest losses at the mid-management level (E-5 to E-6 for enlisted). This particular problem would not lend itself readily to correction from increased accessions even if the manpower pool were not diminishing as it is. With the numbers of 17-21 year olds decreasing steadily over the next ten years, policies aimed at improved retention are recommended as the best solution to enlisted problems at all levels, but particularly at the E-5 to E-6 level where the Navy is currently 20,000 to 22,000 petty officers undermanned. Increased promotion rates, and the financial benefits inherent in such rates, would also in all probability be an aid to providing higher re-enlisted rates and help to provide the enlisted manpower for the FY 1990 fifteen carrier force.

# V. CONCLUSION

The use of computer projections by Navy management level
personnel to enhance the effectiveness of long term accession,
retention and promotion policies can prove of great value.
In this thesis, the application of the MANMOD (Markov Chain
model) computer program to requirement, retention, accession,
promotion and attrition data has yielded an analysis of
alternative means for manning the fifteen carrier airwing
force in FY 1990.

It has been found that unless drastic overall changes are
made in retention figures, the FY 1990 carrier force will be
severely undermanned in most areas of its airwing complement.
There will be a 50 percent shortage of pilots if current trends
in retention continue until 1990. Attaining the required
number of NFO's, on the other hand, seems to present no prob-
lem. With the NFO retention rate at 70 percent and the NFO
promotion rate (LT to LCDR) above 80 percent, the Navy could
afford to reduce the number of NFO accessions and still meet
its requirements.

In terms of enlisted personnel, the Navy as a whole is
presently 20,000 to 22,000 middle grade petty officers under-
manned. The aviation community, as the CREO list (an example
was shown in Table XXIII) indicates, shares heavily in the
deficit. Aviation enlisted data contained in this thesis

show severe shortages in seven of the eleven enlisted ratings studied, particularly at mid-management levels, and lesser shortages in three other rates at the E-4 level. As the fleet increases and demographic trends make maintaining accession levels more difficult, it becomes unrealistic for the Navy to look to the new crop of 17 to 21 year olds to fill its increasing billet requirements, or possibly even to maintain its current manning deficit levels.

A return to the draft would provide manpower at the entry level; however, a more serious problem arises in the field of middle management. Retention of personnel, once acquired, must take a priority place in Navy's policy making. The incentives to both officers and enlisted whose services are in demand in the civilian job market must be such that the personnel will remain.

Present aviation bonus incentives being offered to pilots and NFO's, as well as special sea pay, indicate that Washington has recognized the problem. Whether this new policy will be sufficient to increase the pilot retention rate at the eight or nine year point (LT to LCDR) to the rate needed remains to be seen.

A change in promotion policy, with a more rapid advancement potential and added financial rewards likely to be inherent in such a policy, might prove a valuable weapon in the enlisted retention war. The young men in question (17 to 21 year olds) whose numbers are projected to decline until 1995, are the source from which accessions are overwhelmingly made.

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This thesis concludes that of the officers and eleven enlisted ratings studied, the following will be undermanned in FY 1990 unless immediate policy changes are put into effect:

Officers......Pilots 131X

Enlisted......AT, AD, AE, AME, AMH, AMS and AO--
severe deficits at most levels

Enlisted......AQ, AX, PR--deficits at E-4 level
only.

Those designators/ratings which continue to be available in sufficient numbers are:

Officers......NFO 132X

Enlisted......AW

Careful long term management of Navy manpower resources will continue to be necessary over the coming years, particularly in light of the increased demand for manpower and the shrinking pool of accessible personnel. The utilization of such vehicles as the APL program MANMOD in the projection of data to make long term manning predictions can serve to channel funding decisions and develop policies to maintain the all-volunteer peacetime Navy and to provide for the manning of a larger fleet.

# APPENDIX A

## AIRCRAFT SQUADRON MANPOWER DOCUMENTS FOR OFFICERS


### AIRCRAFT SQUADRON MANPOWER DOCUMENT

### A-7E OFFICER

### 12 AIRCRAFT SQUADRON

| | -------------------Rank--------------------- | | | | | | |
| Designator | W2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| 130X | | | 7 | 6 | 4 | 2 | 19 |
| 1520 | | 1 | | 1 | | | 2 |
| 1630 | | 1 | | | | | 1 |
| 7360 | 1 | | | | | | 1 |
| 7380 | 1 | | | | | | 1 |
| TOTAL | 2 | 2 | 7 | 7 | 4 | 2 | 24 |


Source:  OPNAVINST 5320.102B, Chief of Naval Operations
         OP-111E.

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AIRCRAFT SQUADRON MANPOWER DOCUMENT

E-2C OFFICER

4 AIRCRAFT SQUADRON

| Designator | W2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
|------------|-----|-----|-----|-----|-----|-----|-------|
| 130X |  |  |  |  |  | 2 | 2 |
| 131X |  |  | 6 | 4 | 1 |  | 11 |
| 132X |  |  | 9 | 5 | 3 |  | 17 |
| 1520 |  | 1 |  | 1 |  |  | 2 |
| 1630 |  | 1 |  |  |  |  | 1 |
| 7380 | 1 |  |  |  |  |  | 1 |
| TOTAL | 1 | 2 | 15 | 10 | 4 | 2 | 34 |

Source: OPNAVINST 5320.153B, Chief of Naval Operations
OP-111E.

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# AIRCRAFT SQUADRON MANPOWER DOCUMENT

## EA-6B OFFICER

## 4 AIRCRAFT SQUADRON

| Designator | W2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| 130X | | | | | | 2 | 2 |
| 131X | | | 6 | 2 | 2 | | 10 |
| 132X | | | 16 | 2 | 2 | | 20 |
| 1520 | | | | 1 | | | 1 |
| 1630 | | 1 | | | | | 1 |
| 7360 | 1 | | | | | | 1 |
| 7380 | 1 | | | | | | 1 |
| TOTAL | 2 | 1 | 22 | 5 | 4 | 2 | 36 |

Source:   OPNAVINST 5320.138A, Chief of Naval Operations
          OP-111C2

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AIRCRAFT SQUADRON MANPOWER DOCUMENT

F-4J OFFICER

12 AIRCRAFT SQUADRON

| Designator | W2 | 01 | 02 | Rank 03 | 04 | 05 | TOTAL |
|------------|----|----|----|---------|----|----|-------|
| 130X | | | | | | 2 | 2 |
| 131X | | | 8 | 6 | 2 | | 16 |
| 132X | | | 10 | 4 | 2 | | 16 |
| 1520 | | | | 1 | | | 1 |
| 1630 | | 1 | | | | | 1 |
| 7360 | 1 | | | | | | 1 |
| TOTAL | 1 | 1 | 18 | 11 | 4 | 2 | 37 |

Source: OPNAVINST 5320.255B, Chief of Naval Operations
OP-111C2

# AIRCRAFT SQUADRON MANPOWER DOCUMENT

## F-14 OFFICER

## 12 AIRCRAFT SQUADRON

| Designator | W2 | 01 | 02 | Rank 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| 130X | | | | | | 2 | 2 |
| 131X | | | 9 | 5 | 2 | | 16 |
| 132X | | | 10 | 4 | 2 | | 16 |
| 1520 | | 1 | | | | | 1 |
| 1630 | | 1 | | | | | 1 |
| 3100 | | 1 | | | | | 1 |
| 6380 | | | | 1 | | | 1 |
| 7260 | 1 | | | | | | 1 |
| TOTAL | 1 | 3 | 19 | 10 | 4 | 2 | 39 |

Source: OPNAVINST 5320.170A, Chief of Naval Operations
        OP-111C2

# AIRCRAFT SQUADRON MANPOWER DOCUMENT

## F/A-18 OFFICER

## 12 AIRCRAFT SQUADRON

| Designator | W2 | 01 | 02 | Rank 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| 131X | | | 8 | 3 | 4 | 2 | 17 |
| 1520 | | 1 | | 1 | | | 2 |
| 1630 | | 1 | | | | | 1 |
| 7360 | 1 | | | | | | 1 |
| TOTAL | 1 | 2 | 8 | 4 | 4 | 2 | 21 |

Source:  NTP A-50-7703, Chief of Naval Operations OP-112D32

## AIRCRAFT SQUADRON MANPOWER DOCUMENT

### S-3A OFFICER

### 10 AIRCRAFT SQUADRON

| Designator | W2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
|------------|----|----|----|----|----|----|-------|
| 130X       |    |    |    |    |    | 2  | 2     |
| 131X       |    |    | 17 | 9  | 3  |    | 29    |
| 132X       |    |    | 16 | 9  | 3  |    | 28    |
| 1520       |    |    |    |    | 1  |    | 1     |
| 1630       |    | 1  |    |    |    |    | 1     |
| 3100       |    | 1  |    |    |    |    | 1     |
| 6330       |    |    |    | 1  |    |    | 1     |
| 7321       | 1  |    |    |    |    |    | 1     |
| 7380       | 1  |    |    |    |    |    | 1     |
| TOTAL      | 2  | 2  | 33 | 19 | 7  | 2  | 65    |

Source: OPNAVINST 5320.178A, Chief of Naval Operations
OP-124F

# AIRCRAFT SQUADRON MANPOWER DOCUMENT

## SH-3 OFFICER

### 6 AIRCRAFT SQUADRON

| Designator | W2 | 01 | 02 | Rank 03 | 04 | 05 | TOTAL |
|---|---|---|---|---|---|---|---|
| 131X | | | 12 | 6 | 4 | 2 | 24 |
| 1630 | | 1 | | | | | 1 |
| 6380 | | | | 1 | | | 1 |
| 7321 | 1 | | | | | | 1 |
| 7380 | 1 | | | | | | 1 |
| TOTAL | 2 | 1 | 12 | 7 | 4 | 2 | 28 |

Source: OPNAVINST 5320.177B, Chief of Naval Operations
OP-111E

# AIRCRAFT SQUADRON MANPOWER DOCUMENT

## RF-8 OFFICER

## 4 AIRCRAFT SQUADRON

| | | | | Rank | | | |
|------------|----|----|----|----|----|----|-------|
| Designator | W2 | 01 | 02 | 03 | 04 | 05 | TOTAL |
| 131X       |    |    | 3  | 4  | 3  | 2  | 12    |
| 1520       |    |    |    |    | 1  |    | 1     |
| 1630       |    | 1  |    |    |    |    | 1     |
| 7380       | 1  |    |    |    |    |    | 1     |
| TOTAL      | 1  | 1  | 3  | 4  | 4  | 2  | 15    |

Source:  OPNAVINST 5320.144, Chief of Naval Operations
         OP-111E

# APPENDIX B

## AIRCRAFT SQUADRON MANPOWER DOCUMENTS FOR ENLISTED

### AIRCRAFT SQUADRON MANPOWER DOCUMENT

A-7E ENLISTED

12 AIRCRAFT SQUADRON

| Rating | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 | TOTAL |
|--------|-------|-----|-----|-----|-----|-----|-----|-------|
| AD | 4 | 6 | 5 | 5 | 1 | 1 | | 22 |
| AE | 5 | 6 | 6 | 3 | 1 | 1 | | 22 |
| AK | 2 | 1 | 3 | 1 | | | | 7 |
| AM | | | | | | | 1 | 1 |
| AME | 2 | 2 | 2 | 2 | | | | 8 |
| AMH | 5 | 5 | 3 | 3 | 1 | | | 17 |
| AMS | 7 | 8 | 7 | 3 | 2 | | | 27 |
| AN | 49 | | | | | | | 49 |
| AO | 9 | 8 | 7 | 4 | 1 | | | 29 |
| APO | | | 3 | 1 | | | 1 | 5 |
| AQ | 5 | 6 | 5 | 2 | 1 | 1 | | 20 |
| AT | 4 | 8 | 7 | 1 | 1 | 1 | | 22 |
| AV | | | | | | | 1 | 1 |
| AZ | 2 | 2 | 2 | 1 | | | | 7 |
| DK | | | 1 | | | | | 1 |
| HM | | | 1 | | | | | 1 |
| MS | 3 | 1 | 2 | | | | | 6 |
| NC | | | | 1 | | | | 1 |
| PN | 1 | 1 | 1 | 1 | | | | 4 |
| PO | | 1 | 3 | | | | | 4 |
| PR | 1 | 2 | 1 | 1 | | | | 5 |
| SN | 2 | | | | | | | 2 |
| YN | 2 | 2 | 1 | 1 | | | | 6 |
| TOTAL | 103 | 59 | 60 | 30 | 8 | 4 | 3 | 267 |

Source: OPNAVINST 5320.102B, Chief of Naval Operations OP-111E

AIRCRAFT SQUADRON MANPOWER DOCUMENT

E-2C ENLISTED

4 AIRCRAFT SQUADRON

| Rating | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 | TOTAL |
|--------|-------|----|----|----|----|----|----|-------|
| AD | 2 | 2 | 3 | 3 | | 2 | | 12 |
| AE | 2 | 3 | 4 | 2 | | 1 | | 12 |
| AK | 1 | | 3 | 1 | | | | 5 |
| AM | | | | | | 1 | | 1 |
| AME | 1 | 1 | 1 | 1 | | | | 4 |
| AMH | 2 | 3 | 1 | 1 | 1 | | | 8 |
| AMS | 4 | 3 | 2 | 2 | 1 | | | 12 |
| AN | 27 | | | | | | | 27 |
| APO | | | 2 | 1 | | | 1 | 4 |
| AT | 5 | 8 | 8 | 3 | 2 | 1 | | 27 |
| AV | | | | | | | 1 | 1 |
| AZ | 1 | 2 | 2 | | | | | 5 |
| DK | | | 1 | | | | | 1 |
| HM | | | 1 | | | | | 1 |
| MS | 2 | | 2 | | | | | 4 |
| PN | | 1 | 1 | 1 | | | | 3 |
| PO | | | 3 | 1 | | | | 4 |
| PR | 2 | | 1 | | | | | 3 |
| SN | 2 | | | | | | | 2 |
| YN | | 2 | 1 | 1 | | | | 4 |
| TOTAL | 51 | 25 | 36 | 17 | 4 | 5 | 2 | 140 |

Source: OPNAVINST 5320.153B, Chief of Naval Operations
OP-111E

# AIRCRAFT SQUADRON MANPOWER DOCUMENT

## EA-6B ENLISTED

## 4 AIRCRAFT SQUADRON

| Rating | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 | TOTAL |
|--------|-------|-----|-----|-----|-----|-----|-----|-------|
| ABH    |       |     | 1   |     |     |     |     | 1     |
| AD     | 1     | 2   | 5   | 3   |     | 1   |     | 12    |
| AE     | 2     | 5   | 4   | 2   | 1   |     |     | 14    |
| AF     |       |     |     |     |     |     | 1   | 1     |
| AK     | 1     |     | 3   |     |     |     |     | 4     |
| AME    | 2     | 2   | 1   | 2   |     |     |     | 7     |
| AMH    | 1     | 2   | 3   | 2   |     |     |     | 8     |
| AMS    | 3     | 2   | 3   | 4   |     | 2   |     | 14    |
| AN     | 27    |     |     |     |     |     |     | 27    |
| AO     | 1     |     | 2   |     |     |     |     | 3     |
| APO    |       | 2   | 1   |     |     |     |     | 3     |
| AT     | 6     | 17  | 19  | 5   | 2   | 1   |     | 50    |
| AZ     | 1     | 2   | 2   | 1   |     |     |     | 6     |
| DK     |       |     | 1   |     |     |     |     | 1     |
| HM     |       | 1   |     |     |     |     |     | 1     |
| IM     |       | 1   |     |     |     |     |     | 1     |
| MS     | 2     |     | 2   |     |     |     |     | 4     |
| PN     |       | 1   | 1   | 1   |     |     |     | 3     |
| PO     |       |     | 2   |     |     |     |     | 2     |
| PR     | 1     | 1   | 1   |     |     |     |     | 3     |
| SN     | 1     |     |     |     |     |     |     | 1     |
| YN     | 1     | 3   | 1   | 1   |     |     |     | 6     |
| TOTAL  | 50    | 41  | 52  | 21  | 3   | 4   | 1   | 172   |

Source: OPNAVINST 5320.138A, Chief of Naval Operations
        OP-111C2

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# AIRCRAFT SQUADRON MANPOWER DOCUMENT

## F-4J ENLISTED

## 12 AIRCRAFT SQUADRON

| Rating | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 | TOTAL |
|--------|-------|----|----|----|----|----|----|-------|
| AD    | 4  | 6  | 4  | 5 | 1 | 1 |   | 21  |
| AE    | 4  | 7  | 5  | 2 | 1 | 1 |   | 20  |
| AF    |    |    |    |   |   |   | 1 | 1   |
| AK    | 2  | 1  | 3  | 1 |   |   |   | 7   |
| AM    |    |    |    |   |   | 1 |   | 1   |
| AME   | 3  | 4  | 2  | 2 |   |   |   | 11  |
| AMH   | 3  | 4  | 5  | 2 | 1 |   |   | 15  |
| AMS   | 8  | 4  | 4  | 3 | 2 |   |   | 21  |
| AN    | 45 |    |    |   |   |   |   | 45  |
| AO    | 7  | 6  | 4  | 3 | 1 |   |   | 21  |
| APO   |    |    | 2  | 1 |   |   | 1 | 4   |
| AQ    | 4  | 7  | 4  | 3 | 1 | 1 |   | 20  |
| AT    | 3  | 6  | 5  | 2 |   | 1 |   | 17  |
| AZ    | 2  | 2  | 2  | 1 |   |   |   | 7   |
| DK    |    |    | 1  |   |   |   |   | 1   |
| HM    |    |    | 1  |   |   |   |   | 1   |
| MS    | 2  | 1  | 2  |   |   |   |   | 5   |
| NC    |    |    |    | 1 |   |   |   | 1   |
| OS    |    |    |    | 1 |   |   |   | 1   |
| PN    | 1  | 1  | 1  | 1 |   |   |   | 4   |
| PO    |    | 1  | 2  |   |   |   |   | 3   |
| PR    | 2  | 2  |    | 1 |   |   |   | 5   |
| SN    | 3  |    |    |   |   |   |   | 3   |
| YN    | 3  | 2  |    | 1 |   |   |   | 6   |
| TOTAL | 96 | 54 | 47 | 30 | 7 | 5 | 2 | 241 |

Source:  OPNAVINST 5320.255B, Chief of Naval Operations OP-111C2

# AIRCRAFT SQUADRON MANPOWER DOCUMENT

## F-14 ENLISTED

## 12 AIRCRAFT SQUADRON

| Rating | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 | TOTAL |
|---|---|---|---|---|---|---|---|---|
| AD | 4 | 10 | 5 | 5 | 2 | 1 | | 27 |
| AE | 5 | 7 | 7 | 3 | 1 | 1 | | 24 |
| AF | | | | | | | 1 | 1 |
| AK | 2 | 1 | 3 | 1 | | | | 7 |
| AM | | | | | | | 1 | 1 |
| AME | 2 | 4 | 3 | 2 | | | | 11 |
| AMH | 4 | 4 | 5 | 3 | 1 | | | 17 |
| AMS | 6 | 5 | 5 | 3 | 1 | | | 20 |
| AN | 46 | | | | | | | 46 |
| AO | 7 | 6 | 5 | 3 | 1 | | | 22 |
| APO | | | 2 | 1 | | | 1 | 4 |
| AQ | 3 | 6 | 10 | 2 | 1 | 1 | | 23 |
| AT | 5 | 7 | 8 | 1 | 1 | 1 | | 23 |
| AZ | 1 | 2 | 2 | 1 | | | | 6 |
| DK | | | 1 | | | | | 1 |
| HM | | | 1 | | | | | 1 |
| MS | 2 | 1 | 2 | | | | | 5 |
| NC | | | | 1 | | | | 1 |
| OS | | | | 1 | | | | 1 |
| PN | 1 | 1 | 1 | 1 | | | | 4 |
| PO | | 1 | 2 | | | | | 3 |
| PR | 1 | 1 | 2 | | | | | 4 |
| SN | 2 | | | | | | | 2 |
| YN | | 3 | 2 | | 1 | | | 6 |
| TOTAL | 91 | 59 | 66 | 28 | 9 | 4 | 3 | 260 |

Source:  OPNAVINST 5320.170A, Chief of Naval Operations
OP-111C2

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AIRCRAFT SQUADRON MANPOWER DOCUMENT

F/A-18 ENLISTED

12 AIRCRAFT SQUADRON

| Rating | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 | Total |
|--------|-------|-----|-----|-----|-----|-----|-----|-------|
| AD | 4 | 5 | 3 | 3 | 1 | 1 | | 17 |
| AE | 3 | 4 | 6 | 2 | 1 | | | 16 |
| AF | | | | | | | 1 | 1 |
| AK | 2 | 1 | 3 | 1 | | | | 7 |
| AM | | | | | | 1 | | 1 |
| AME | 1 | 2 | 2 | 1 | | | | 6 |
| AMH | 3 | 3 | 4 | 4 | 1 | | | 15 |
| AMS | 5 | 5 | 4 | 3 | 1 | | | 18 |
| AN | 40 | | | | | | | 40 |
| AO | 8 | 6 | 6 | 4 | 1 | | | 25 |
| APO | | | 2 | 2 | | | 1 | 5 |
| AQ | 2 | 4 | 6 | 3 | | 1 | | 16 |
| AT | 2 | 3 | 6 | 1 | | 1 | | 13 |
| AZ | 1 | 2 | 2 | 1 | | | | 6 |
| DK | | | 1 | | | | | 1 |
| HM | | | 1 | | | | | 1 |
| MS | 2 | | 2 | | | | | 4 |
| PN | | 1 | 1 | 1 | | | | 3 |
| PO | | 1 | 2 | | | | | 3 |
| PR | 1 | | 2 | | | | | 3 |
| SN | 2 | | | | | | | 2 |
| YN | 1 | 2 | 1 | 1 | | | | 5 |
| TOTAL | 77 | 39 | 54 | 27 | 5 | 4 | 2 | 208 |

Source: NTP A-50-7703, Chief of Naval Operations OP-112D32

# AIRCRAFT SQUADRON MANPOWER DOCUMENT

## S-3A ENLISTED

### 10 AIRCRAFT SQUADRON

| Rating | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 | Total |
|--------|-------|-----|-----|-----|-----|-----|-----|-------|
| AD     | 5     | 7   | 3   | 3   | 2   | 1   |     | 21    |
| AE     | 8     | 6   | 6   | 3   | 1   | 1   |     | 25    |
| AK     | 1     | 2   | 3   | 1   |     |     |     | 7     |
| AM     |       |     |     |     |     |     | 1   | 1     |
| AME    | 3     | 3   | 3   | 2   |     |     |     | 11    |
| AMH    | 2     | 4   | 4   | 2   | 1   |     |     | 13    |
| AMS    | 6     | 7   | 4   | 3   |     |     |     | 20    |
| AN     | 50    |     |     |     |     |     |     | 50    |
| AO     | 5     | 2   | 2   | 3   | 1   |     |     | 13    |
| APO    |       |     | 2   | 2   |     |     | 1   | 5     |
| AT     | 10    | 10  | 9   | 2   | 1   | 1   |     | 33    |
| AV     |       |     |     |     |     |     | 1   | 1     |
| AW     | 5     | 5   | 6   | 2   | 2   |     |     | 20    |
| AX     | 4     | 5   | 3   | 3   | 1   | 1   |     | 17    |
| AZ     | 2     | 2   | 2   | 1   |     |     |     | 7     |
| DK     |       |     | 1   |     |     |     |     | 1     |
| HM     |       |     | 1   |     |     |     |     | 1     |
| IS     |       | 1   |     |     |     |     |     | 1     |
| MS     | 3     | 1   | 2   |     |     |     |     | 6     |
| PN     | 1     | 1   | 1   | 1   |     |     |     | 4     |
| PO     |       |     | 2   |     |     |     |     | 2     |
| PR     | 4     | 1   | 2   | 1   |     |     |     | 8     |
| SN     | 2     |     |     |     |     |     |     | 2     |
| YN     | 3     | 2   |     | 1   |     |     |     | 6     |
| TOTAL  | 114   | 59  | 56  | 30  | 9   | 4   | 3   | 275   |

Source:  OPNAVINST 5320.178A, Chief of Naval Operations
         OP-124F

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# AIRCRAFT SQUADRON MANPOWER DOCUMENT

## SH-3 ENLISTED

## 6 AIRCRAFT SQUADRON

| Rating | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 | TOTAL |
|--------|-------|-----|-----|-----|-----|-----|-----|-------|
| AD | 4 | 4 | 3 | 3 | 1 | 1 | | 16 |
| AE | 3 | 3 | 2 | 2 | | 1 | | 11 |
| AF | | | | | | | 1 | 1 |
| AK | 1 | | 3 | | | | | 4 |
| AM | | | | | | 1 | | 1 |
| AME | | | 1 | | | | | 1 |
| AMH | 1 | 2 | 1 | 1 | | | | 5 |
| AMS | 4 | 4 | 2 | 3 | 1 | | | 14 |
| AN | 33 | | | | | | | 33 |
| AO | 2 | 1 | 1 | 2 | | | | 6 |
| APO | | | 2 | 1 | | | 1 | 4 |
| AT | 2 | 2 | 3 | 1 | 1 | | | 9 |
| AW | 8 | 6 | 6 | 2 | 1 | | | 23 |
| AX | 2 | 4 | 2 | 1 | | | | 9 |
| AZ | 1 | 2 | 2 | 1 | | | | 6 |
| DK | | | 1 | | | | | 1 |
| HM | | | 1 | | | | | 1 |
| MS | 2 | 1 | 2 | | | | | 5 |
| PN | 1 | 1 | 1 | | | | | 3 |
| PO | | | 2 | 1 | | | | 3 |
| PR | 2 | 1 | 1 | | | | | 4 |
| SN | 2 | | | | | | | 2 |
| YN | 1 | 2 | 1 | 1 | | | | 5 |
| TOTAL | 69 | 33 | 37 | 19 | 4 | 3 | 2 | 167 |

Source: OPNAVINST 5320.177B, Chief of Naval Operations
        OP-111E

AIRCRAFT SQUADRON MANPOWER DOCUMENT

RF-8 ENLISTED

6 AIRCRAFT SQUADRON

| Rating | E1-E3 | E4 | E5 | E6 | E7 | E8 | E9 | TOTAL |
|---|---|---|---|---|---|---|---|---|
| AD | 1 | 2 | 4 | 2 | | 1 | | 10 |
| AE | 2 | 4 | 3 | 2 | 1 | | | 12 |
| AK | 1 | | 3 | | | | | 4 |
| AME | 2 | 3 | 1 | 2 | | | | 8 |
| AMS | 2 | 2 | 3 | 4 | | 2 | | 13 |
| AN | 27 | | | | | | | 27 |
| APO | | | 2 | 1 | | | | 3 |
| AT | 6 | 15 | 16 | 4 | 2 | 1 | | 44 |
| AV | | | | | | | 1 | 1 |
| AZ | 1 | 2 | 2 | | | | | 5 |
| DK | | | 1 | | | | | 1 |
| HM | | 1 | | | | | | 1 |
| MS | 2 | | 2 | | | | | 4 |
| PN | | 1 | 1 | 1 | | | | 3 |
| PO | | | 2 | | | | | 2 |
| PR | 1 | 1 | 1 | | | | | 3 |
| SN | | 1 | | | | | | 1 |
| YN | 2 | 1 | 1 | | | | | 4 |
| TOTAL | 47 | 33 | 42 | 16 | 3 | 4 | 1 | 146 |

## APPENDIX C

## RATING NAMES

| Rating Abbreviation | Rating Name |
| --- | --- |
| AD | Aviation Machinist's Mate |
| AE | Aviation Electrician's Mate |
| AME | Aviation Structural Mechanic (Safety Equipment) |
| AMH | Aviation Structural Mechanic (Hydraulics) |
| AMS | Aviation Structural Mechanic (Structures) |
| AO | Aviation Ordnanceman |
| AQ | Aviation Fire Control Technician |
| AT | Aviation Electronics Technician |
| AW | Aviation Antisubmarine Warfare Operator |
| AX | Aviation Antisubmarine Warfare Technician |
| PR | Aircrew Survival Equipmentman |

# APPENDIX D

## INSTRUCTION FOR IMPLEMENTATION OF A MANMOD
## COMPUTER RUN

After the MANMOD program is keyed into a computer work space, the following steps are required in order to accomplish a computer run.

STEP 1.  When in the MANMOD APL program (at the Naval Postgraduate School this is accomplished by logging onto a computer terminal equipped for APL.  First type APL (press ENTER), then press the ALT key and the APL ON/OFF key simultaneously.  Next, type LOAD MANMOD (press ENTER) (The right paren is the orange printed paren key pressed in conjunction with the upper case key) (The only space required is between LOAD and MANMOD)), type INPUT (press ENTER).  This starts the MANMOD program.

STEP 2.   The program will request:
ENTER N(INITIAL CLASS VALUES)--This will be the initial numbers (stocks) of individuals that are in each year group selected for study.  It is implicit in this specification that time is descrete and in practice the unit of time will usually be a year.  (In this thesis the groups covered a nine or ten year period.  So the N vector would look like this for a nine year vector: 185 156 57 56 56 18 17 17 13.

STEP 3.  After the initial class values are entered via the ENTER key, the program will request:
ENTER P(TRANSITION MATRIX)
ENTER 1TH ROW----------This is called the transition matrix and each row vector is called the position vector. It is also implicit that these specifications are time descrete and are usually in year units.  The elements of vector will be assigned numerical values and this is accomplished by making hypothetical assumptions or by estimating the probabilies from past data.  The program requires one row for each stock group entered in step 2.  The main diagonal shows the percentage of individuals remaining in a year group.  To the left of the main diagonal would be those individuals that are demoted.

On the right side of the diagonal would be the promotion rates. In this thesis there was a continuous flow from one year to the next with no one individual being retained from one year group to the next and there are no demotions. This allows only the assumptions/probabilities to fall directly in the spaces to the right of the main diagonal. All other entries would be zero, i.e.:

```
lth row  0 .9 0 0 0 0 0 0 0
2th row  0 0 .8 0 0 0 0 0 0
3th row  0 0 0 .7 0 0 0 0 0
etc.
```

STEP 4. After the P matrix is entered, the program will request:
ENTER NUMBER OF RECRUIT TYPE:
    1  FIXED RECRUIT VECTOR
    2  ADDITIVE(RECRUIT SIZE)
    3  MULTIPLICATIVE(RECRUIT SIZE)
    4  ADDITIVE(SYSTEM SIZE)
    5  MULTIPLICATIVE(SYSTEM SIZE)----------This gives
the operator the chance to choose various types of recruitment systems. (This thesis used recruit type 1. It would mean that over a ten year period, at 100 recruits per year, a total of 1000 recruits are recruited. The additive and multiplicative aspect allows a compound recruitment. Also, the additive and multiplicative mode can be applied to the whole system and not just recruited at the first year point.

STEP 5. If other than number one was chosen from step 4, additional information is requested as follows for each case:
ADDITIVE(RECRUIT SIZE)--ENTER RPROP(RECRUIT PROPORTION VECTOR)--ENTER RSIZE(RECRUITMENT SIZE)--and ADDITIVE INCREMENT(RSUM).

MULTIPLICATIVE(RECRUIT SIZE)--(The request is the same as above with the exception that the last request asks for MULTIPLICATIVE FACTS(FAST)).

ADDITIVE OR MULTIPLICATIVE(SYSTEM SIZE)--ENTER RPROP (RECRUIT PROPORTION VECTOR) with either ADDITIVE INCREMENT(RSUM) or MULTIPLICATIVE FACTION(FACT) as required.

For additional information on recruit type selections, contact Professor Milch at the Naval Postgraduate School.

STEP 6. If number 1 was selected from Step 4, then only the requirement ENTER R(RECRUITMENT VECTOR) is requested. When all recruits are entered at the lowest level, the vector will be as follows. The amount of recruits is

placed first followed by zeroes for each year in N, i.e., 100 0 0 0 0 0 0 0 0. There would be other numbers in the vector if lateral entry was considered. (There was no lateral entry considered in this thesis.)

STEP 7.  Next the program requests:
ENTER PERCENT CODE
    0   NO GRADE PERCENTAGE
    1   GRADE SIZE AS PERCENTAGE OF TOTAL GRADE SIZE
    2   GRADE SIZE AS PERCENTAGE OF ORIGINAL GRADE SIZE
Usually number one is chosen. (The percentage calculations will be in the output program next to the total number in each year group.)

STEP 8.  In this step the program requests:
DO YOU WISH TO SEE INTERVENING YEARS
    0   NO
    1   YES
If 1 is chosen and it is desired to produce a program that is calculated for 100 years, then the program will show the figures from year 0 through year 100.  If a look at each individual year is not desired, then a selection of 0 will give only the 0 and 100 year.

STEP 9.  After step 8 is accomplished, the program will show--END OF INPUT PROGRAM.  At this point ask the program to compute the data over a period of years.  If a ten year look is required, type in BASEQN 10, and if a 100 year look is needed, type in BASEQN 100. (The system will only compute up to 999 years.)  Once a year has been selected, one cannot request that year or any year preceding without resetting.  To reset, type RESET (press ENTER) and reselect whatever year required.

STEP 10.  If changes to the original input data are desired, the following procedure needs to be accomplished.

To change N(INITIAL CLASS VALUES)--type N ← x.  Enter the new values of N at x.  The arrow is the APL orange arrow.

To change P(TRANSITION MATRIX)--type P(x;y) ← z.  The x is the row and the y is the column position where the change is required.  The z is the new value.  Use the orange parens (APL) typed without the upper case key being depressed.  The arrow is the same arrow as in the above procedure.  The semicolon is the orange APL semicolon.

To change R(RECRUITMENT VECTOR)--type R ← x.  The new values of R are recorded at x.  The arrow is the APL arrow used in the above procedures.

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To change INTERVENING YEARS--type LINES ← x.  The x will
either be a 0 or a 1.  The arrow is the same.

   Other changes may be made to the program and for further
information contact Professor Milch, code 55 Mh, at the Naval
Postgraduate School.  Also, all changes should be made after
resetting is accomplished unless specific changes eliminate
computational errors.

   If a printed copy of the MANMOD computer run is desired,
then complete the following:

STEP 1.   After logging onto the computer type CP SPOOL
CONSOLE START * CLASS A (press ENTER).  This will start
a spool that will record all further entries into the
computer (mistakes included).

STEP 2.   Type APL (press ENTER).  This logs one into the
APL mode of operation.

STEP 3.   Press the ALT key and the APL ON/OFF key at the
same time.  This gives you control of the APL characters.
(orange colored keys).

STEP 4.   Type )LOAD MANMOD (press ENTER) (the right paren
is the orange paren pressed in conjunction with the upper
case key).  This has recalled the MANMOD APL program.

STEP 5.   Type INPUT (press ENTER).  This starts the
program.  Make all entries required.

STEP 6.   After the program run is completed, type )OFF
HOLD (press ENTER) (the right paren is the same as the
one in step 4).  This places the computer back into the
CPU mode; (if) OFF is selected then the individual has
logged off the computer altogether).

STEP 7.   Type CP SPOOL CONSOLE CLOSE (press ENTER).
This stops information from being recorded on the spool.

STEP 8.   Type READ _ _ _ _ _ _ _ _    (Each underlined
section can have up to eight characters and will become
the file name for the computer run (press ENTER).

STEP 9.   Type CP SPOOL CONSOLE STOP (press ENTER).
This makes sure that the spool is no longer recording
and all information recorded is lost.  (The READ
_ _ _ _ _ _ _ _ records program into personal storage
space.)

STEP 10.  The new file can be printed by typing PRINT
                    (name given new file) or alternately
first go to XEDIT mode and add or erase information as
needed and then go to PRINT.

This file is now saved in the operator's personal
storage space and can be erased or kept as the operator
desires.

## MANMOD APL PROGRAM

```
      ∇INPUT[□]∇
      ∇ INPUT;I;K;PI;ERRMSG
[1]   ERRMSG←'ERROR: DIMENSION NOT COMPATIBLE WITH N-VECTOR.
      TRY AGAIN!'
[2]   I←1
[3]   'ENTER N(INITIAL CLASS VALUES)'
[4]   N←,□
[5]   K←ρN
[6]   'ENTER P(TRANSITION MATRIX) BY ROWS'
[7]   P←(K,K)ρ0
[8]  PINPUT:'ENTER ',(▼I),'TH ROW'
[9]   PI←,□
[10]  →INSERT×ιK=ρPI
[11]  ERRMSG
[12]  →PINPUT
[13] INSERT:P[I;]←PI
[14]  →PINPUT×ιK≥I←I+1
[15]  'ENTER NUMBER OF RECRUIT TYPE'
[16]  '       1    FIXED RECRUIT VECTOR'
[17]  '       2    ADDITIVE(RECRUIT SIZE)'
[18]  '       3    MULTIPLICATIVE(RECRUIT SIZE)'
[19]  '       4    ADDITIVE(SYSTEM SIZE)'
[20]  '       5    MULTIPLICATIVE(SYSTEM SIZE)'
[21]  TYPE←□
[22]  →(TYPE≠1)/RPROPENTRY
[23] RV:'ENTER R(RECRUITMENT VECTOR)'
[24]  R←,□
[25]  RPROP←Kρ0
[26]  →NEXT×ιK=ρR
[27]  ERRMSG
[28]  →RV
[29]  →NEXT
[30] RPROPENTRY:'ENTER RPROP(RECRUIT PROPORTION VECTOR)'
[31]  RPROP←,□
[32]  →CHECK1×ιK=ρRPROP
[33]  ERRMSG
[34]  →RPROPENTRY
[35] CHECK1:→((TYPE=4)∨TYPE=5)/CHECK2
[36]  'ENTER RSIZE(INITAL RECRUIT TOTAL ENTERING SYSTEM)'
[37]  RSIZE←□
[38] CHECK2:→((TYPE=3)∨TYPE=5)/MULT
[39] ADD:'ENTER ADDITIVE INCREASE'
```

```
[40]    INC←□
[41]    →NEXT
[42] MULT:'ENTER MULTIPLICATIVE FACTOR'
[43]    FACT←□
[44]    R←Kρ0
[45]    →NEXT
[46] NEXT:'ENTER PERCENT CODE'
[47]    '       0    NO GRADE PERCENTAGES'
[48]    '       1    GRADE SIZE AS PERCENT OF TOTAL GRADE SIZE'
[49]    '       2    GRADE SIZE AS PERCENT OF ORIGINAL GRADE SIZE'
[50]    PCODE←□
[51]    'DO YOU WISH TO SEE INTERVENING YEARS'
[52]    '       0    NO'
[53]    '       1    YES'
[54]    LINES←□
[55]    TCOUNT←0
[56] END:'END OF INPUT PROGRAM'
      ∇


      ∇OUTPUT[□]∇
      ∇ OUTPUT
[1]     I←0
[2]     →(TCOUNT>0)/CHECK
[3]  SETUP:PFORM←',□(□,I4,□)□'
[4]     FIRSTLINE←'I3,X3,I2,X,I9,X'
[5]     FIRSTLINE12←FIRSTLINE,PFORM
[6]     MIDLINE←'X6,I2,X,I9,X'
[7]     MIDLINE12←MIDLINE,PFORM
[8]     LASTLINE←'X4,□TOTAL□,I9,X'
[9]     LASTLINE←LASTLINE,PFORM,',I6'
[10]    '   T              N      PERCENT      R'
[11]    '================================='
[12] CHECK:→(PCODE= 0 1 2)/COLOUT0,COLOUT12,COLOUT12
[13] COLOUT0:I←I+1
[14]    →(I>K)/LAST
[15]    →(I>1)/MID0
[16] FIRST0:FIRSTLINE ΔFMT TCOUNT,I,N[I]
[17]    →COLOUT0
[18] MID0:MIDLINE ΔFMT I,N[I]
[19]    →COLOUT0
[20] COLOUT12:I←I+1
[21]    →(I>K)/LAST
[22]    →(I>1)/MID12
[23] FIRST12:FIRSTLINE12 ΔFMT TCOUNT,I,N[I],PERCENT[I]
[24]    →COLOUT12
[25] MID12:MIDLINE12 ΔFMT I,N[I],PERCENT[I]
[26]    →COLOUT12
[27] LAST:LASTLINE ΔFMT TOTAL,TOTPERCENT,RSUM
[28]    '--------------------------------'
      ∇
```

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```
      ∇BASEQN[□]∇
      ∇ BASEQN T
[1]    →(TCOUNT=0)/SETUP
[2]    →(T<TCOUNT)/ERROR1
[3]    →START
[4]    SETUP:N←N
[5]    RPROP←RPROP
[6]    TYPE←TYPE
[7]    P←P
[8]    ONE←(K←ρN)ρ↓1
[9]    ANSWER←0 ROUND 0,(1,K)ρNINT←N
[10]   TOTAL←TOTAL←ONE+.×N
[11]   RECRUIT 0
[12]   R←R
[13]   →OUTPUTDATA
[14]   START:NINT←N+.×P
[15]   TCOUNT←TCOUNT+1
[16]   RECRUIT TCOUNT
[17]   ANSWER←ANSWER,[1] 0 ROUND TCOUNT,N←NINT+R
[18]   TOTAL←⌊(0.5+ONE+.×N)
[19]   →((TCOUNT=T)∨LINES=1)/OUTPUTDATA
[20]   →START
[21]   OUTPUTDATA:TOTAL←⌊(0.5+ONE+.×N)
[22]   TOTPERCENT←⌊(0.5+100×TOTAL DIV TOTAL)
[23]   RSUM←⌊(0.5+ONE+.×R)
[24]   →(PCODE= 1 2)/PCALC1,PCALC2
[25]   →SKIP
[26]   PCALC1:PERCENT←⌊(0.5+100×N÷TOTAL)
[27]   →SKIP
[28]   PCALC2:PERCENT←⌊(0.5+100×N÷TOTAL)
[29]   SKIP:OUTPUT
[30]   CHECK:→(TCOUNT<T)/START
[31]   →0
[32]   ERROR1:'TIME REQUESTED HAS BEEN PAST'
[33]   →0
      ∇




      ∇RESET[□]∇
      ∇ RESET
[1]    TCOUNT←0
[2]    N←N
[3]    RPROP←RPROP
[4]    TYPE←TYPE
[5]    P←P
[6]    'RESET COMPLETED'
      ∇
```

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```
     ∇RECRUIT[□]∇
     ∇ RECRUIT T
[1]    →(TYPE= 1 2 3 4 5)/OUT,ADDREC,MULTREC,ADDSYS,MULTSYS
[2]    'INVALID OR MISSING RECRUIT TYPE CODE'
[3]    →0
[4]   ADDREC:R←(RSIZE+T×INC)×RPROP
[5]    →0
[6]   MULTREC:R←(RSIZE×FACT*T)×RPROP
[7]    →0
[8]   ADDSYS:R←(INC+TOTAL-NINT+.×ONE)×RPROP
[9]    →0
[10] MULTSYS:R←(((FACT-1)×TOTAL)+TOTAL-NINT+.×ONE)×RPROP
[11]   →0
[12] OUT:→0
     ∇
```

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